# COMPETITIVE LEASE APPLICATION NM 28093

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# ENVIRONMENTAL ASSESSMENT

# COMPETITIVE LEASE APPLICATION NM 28093

United States Department of the Interior

Bureau of Land Management

Albuquerque District

July 1979

Bureau of Land Management
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## SUMMARY

Department of the Interior, Bureau of Land Management
Type of Action: Administration (x) Legislative ( )

### Description of the Action

The proposed action evaluated is the offering for competitive lease and subsequent mining of Federal coal reserves on 3,855 acres near Farmington, New Mexico. Surface ownership consists of 2,815 Federal and 1,040 private acres. This action is in response to Competitive Lease Application NM 28093 filed by Western Coal Co. on April 29, 1976 and designated for processing under the terms of NRDC v. Hughes amended order of June 14, 1978.

Impact assessment is based on underground mining methods developed from information submitted by Western Coal Co. Coal would be mined by conventional room-and-pillar methods and transported by conveyor to a processing point for marketing.

### Summary of Environmental Consequences

The surface disturbance on about 30 to 49 acres would result in destruction of vegetation, disturbance of soils, reduced wildlife habitat, reduced carrying capacity for grazing, increased erosion, increased sediment loads, and destruction of archeological sites. Subsidence of 6 to 10 feet that could occur on a maximum of 3,855 to 4,504 acres would increase channel erosion, destroy up to 69 archeological sites, affect existing rights-of-way and use of the area for future roads, and possibly destroy McCabe Dam. Increased human activity in the area may result in increased unauthorized collection of vertebrate fossils and cultural resources, livestock harassment, reduced habitation by threatened and endangered species of wildlife, and illegal shooting of wildlife.

Mining and processing of the coal would result in particulate emissions, increased noise, increased traffic and increased traffic fatalities. Mining also would conflict with possible oil, gas, and uranium development on the area, and would limit future surface uses of the Federal land. Tax revenues to New Mexico would be increased.

### Alternatives Considered

1. Proposed Action
2. No-Action
3. Other-Owner
4. Delay-the-Action
5. Surface-Mining

### Comment Requests

Comments have been requested from the governmental agencies, private groups, and individuals listed on page V-2.

Date Environmental Assessment Made Available: July 23, 1979

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# CHAPTER I

# PROPOSED ACTION AND OTHER ALTERNATIVES

# CHAPTER I

## PROPOSED ACTION AND OTHER ALTERNATIVES

This Environmental Assessment (EA) analyzes the effects of coal mining that would occur if a lease was granted for reserves of Federal coal underlying 3,855 acres, about 6 miles northwest of Farmington, New Mexico (see Map I-1). A proposed action and four other alternatives are evaluated in this EA. The cumulative impacts of mining this coal and other coal-related activities are addressed in Volume 1 of the Star Lake-Bisti Regional Coal Environmental Statement (U.S. Dept. of Interior, Bureau of Land Management, 1979b).

### A. Purpose and Need for Action

On April 29, 1976, Competitive Lease Application (CLA) NM 28093 was filed with the Bureau of Land Management (BLM) by Western Coal Co. (Western). If Western successfully acquires the lease, coal mined from the proposed lease area would be burned at the nearby San Juan Generating Station. This station is a coal-fired electric generating facility owned jointly by Public Service Company of New Mexico (PNM) and Tucson Electric Power Company (TEPCo). The generating station began operation in November, 1973 and is currently being expanded, as shown in Table I-1. The power generated at this facility is used to help meet the base-load requirements of PNM and TEPCo (U.S. Dept. of Interior, Bureau of Reclamation, 1977).

Western, a wholly owned subsidiary of PNM and TEPCo, has a long-term contract to supply coal to the San Juan Generating Station through the year 2015. Under the terms of the fuel supply agreement with PNM and TEPCo, Western is committed to deliver between 190 and 204 million tons of coal to the generating station during its years of operation.

Western's coal delivery requirements have been and are currently being met by production from Western's San Juan Surface Mine. This mine originally contained about 66.7 million tons of reserves accessible by surface mining techniques. To date, 9.9 million tons of coal have been removed. Coal currently is being mined at the rate of 2.6 million tons per year. To meet the needs of the generating station, delivery of coal by Western will need to be increased. As shown in Table I-2, production from the surface mine alone cannot meet the future needs of the generating station.

The San Juan Surface Mine also is used as a disposal site for ash from the generating station (U.S. Dept. of Interior, Bureau of Reclamation, 1977). Western is committed to operate the surface mine through the year 2015 to insure the availability of an ash-disposal site. The company is attempting to reduce current surface mine production by securing other sources of coal, so that the life of the mine can be extended to equal the life of the generating station.

## MAP I-1

## GENERAL LOCATION OF COMPETITIVE LEASE APPLICATION NM28093

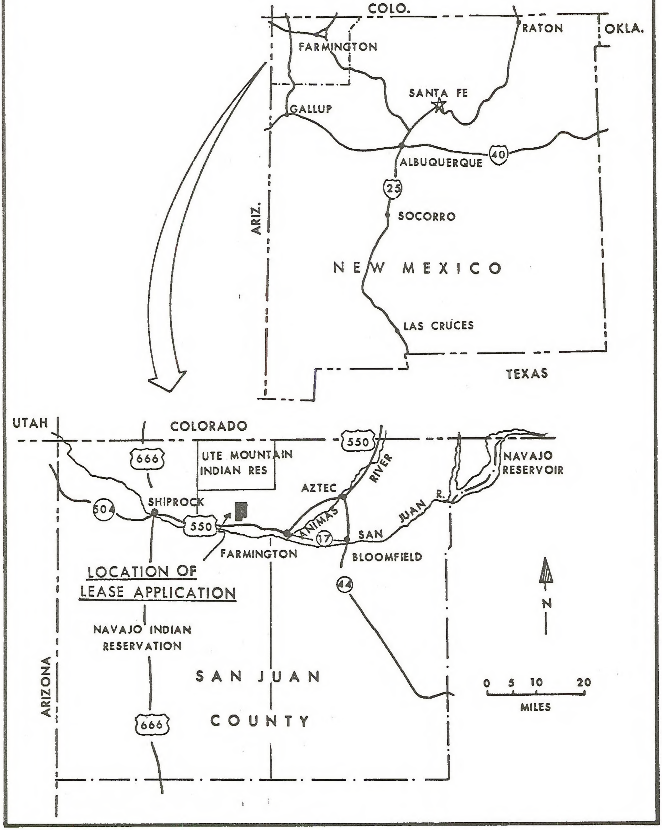


Table I-1

## DEVELOPMENT SCHEDULE OF THE SAN JUAN GENERATING STATION

| Generating Unit No. | Year on Line | Gross Rated Generating Capacity (megawatts) |
|---|---|---|
| 1 | 1976 | 361 |
| 2 | 1973 | 350 |
| 3 | 1979 | 534 |
| 4 | 1982 | 534 |
| Total | | 1,779 |

## TABLE I-2

### PAST AND PROJECTED PRODUCTION FOR THE SAN JUAN SURFACE AND DEEP MINE AND PROJECTED FUEL REQUIREMENTS FOR THE SAN JUAN GENERATING STATION [1]

| Year | San Juan Surface Mine x $10^3$ Tons | San Juan Deep Mine<br>Existing Lease x $10^3$ Tons | San Juan Deep Mine<br>Proposed Lease x $10^3$ Tons | Generating [2] Station Requirement x $10^3$ Tons |
|---|---|---|---|---|
| 1973-1979 | 9,873 [3] | - | - | 9,653 |
| 1979 [4] | 2,600 | | | 2,600 |
| 1980 | 2,000 | 284 | | 4,327 |
| 1981 | 2,000 | 352 | | 5,073 |
| 1982 | 2,000 | 541 | 135 | 6,345 |
| 1983 | 2,000 | 836 | 836 | 6,471 |
| 1984 | 2,000 | 500 | 1,500 | 6,471 |
| 1985 | 2,000 | 500 | 1,500 | 6,471 |
| 1986 | 1,800 | 500 | 1,500 | 6,492 |
| 1987 | 1,800 | 500 | 1,500 | 6,492 |
| 1988 | 1,800 | 500 | 1,500 | 6,492 |
| 1989 | 1,800 | | 2,000 | 6,492 |
| 1990 | 1,800 | | 2,000 | 6,411 |
| 1991 | 1,800 | | 2,000 | 6,411 |
| 1992 | 1,800 | | 2,000 | 6,329 |
| 1993 | 1,800 | | 2,000 | 6,246 |
| 1994 | 1,800 | | 2,000 | 6,246 |
| 1995 | 1,800 | | 2,000 | 5,999 |
| 1996 | 1,800 | | 2,000 | 5,873 |
| 1997 | 1,800 | | 2,000 | 5,873 |
| 1998 | 1,500 | | 2,000 | 5,484 |
| 1999 | 1,500 | | 2,000 | 5,321 |
| 2000 | 1,500 | | 2,000 | 5,195 |
| 2001 | 1,500 | | 2,000 | 4,943 |
| 2002 | 1,500 | | 2,000 | 4,775 |
| 2003 | 1,500 | | 2,000 | 4,523 |
| 2004 | 1,500 | | 2,000 | 4,523 |
| 2005 | 1,500 | | 2,000 | 4,271 |
| 2006 | 1,500 | | 2,000 | 4,271 |
| 2007 | 1,500 | | 2,000 | 4,018 |
| 2008 | 1,100 | | 2,000 | 4,060 |
| 2009 | 1,100 | | 2,000 | 4,060 |
| 2010 | 1,100 | | 2,000 | 4,060 |
| 2011 | 1,100 | | 2,000 | 4,060 |
| 2012 | 1,100 | | 2,000 | 4,060 |
| 2013 | 1,100 | | 2,000 | 4,060 |
| 2014 | 1,100 | | 2,000 | 4,060 |
| 2015 | 483 | | 2,000 | 4,125 |
| | 69,256 [5] | 4,513 [6] | 62,471 [7] | 203,636 |

---

[1] The estimated recoverable reserves in the San Juan surface and deep mines do not fill the projected requirements of the generating station. Additional coal will be required from an unknown source.

[2] Projected requirements from U.S. Dept. of Interior, Bureau of Reclamation, 1977.

[3] Figure represents actual production through April 1979.

[4] These values and values for future years are projected for whole years.

[5] The total recoverable reserves in the surface mine are estimated to be 66,714 x $10^3$ tons. Actual annual production will depend on the amount recovered from the deep mine (existing and proposed lease if Western is the successful bidder) and amount of coal transported in from an unknown source.

[6] Total estimated recoverable reserves in the deep mine (existing lease) range from 14 x $10^6$ tons to 21 x $10^6$ tons depending on number of seams mined and mining methods employed. Annual mining rates after 1988 are not known at the present time.

[7] Total estimated recoverable reserves in the deep mine (proposed lease) range from 50 x $10^6$ tons to 70 x $10^6$ tons depending on number of seams mined and mining methods employed. Annual mining rates shown are projections.

Attempts by Western to purchase some of the additional coal needed for the generating station have been unsuccessful. Negotiations to buy coal from the nearby Navajo Mine and the proposed Burnham Mine have been stalled by the inability of the companies developing these mines to obtain a railroad right-of-way through the Navajo Reservation.

Western plans to increase production from its own coal reserves by opening an underground mine on existing leases (see Maps I-2 and I-3, and Chapter II, Section A). An eventual production of 2 million tons per year from this underground mine would help the company meet its commitments for coal delivery to the generating station.

If Western successfully acquires CLA NM 28093, coal from the proposed lease area would be mined in conjunction with the planned underground mine. In addition, Western would gain access to the coal on their state lease in T. 30 N., R. 15 W., NMPM, Sec. 36 (see Maps I-2 and I-3). This expanded underground mine would increase Western's capacity to provide the fuel required through the life of the generating station.

## B. Proposed Action and Other Alternatives

### 1. Proposed Action

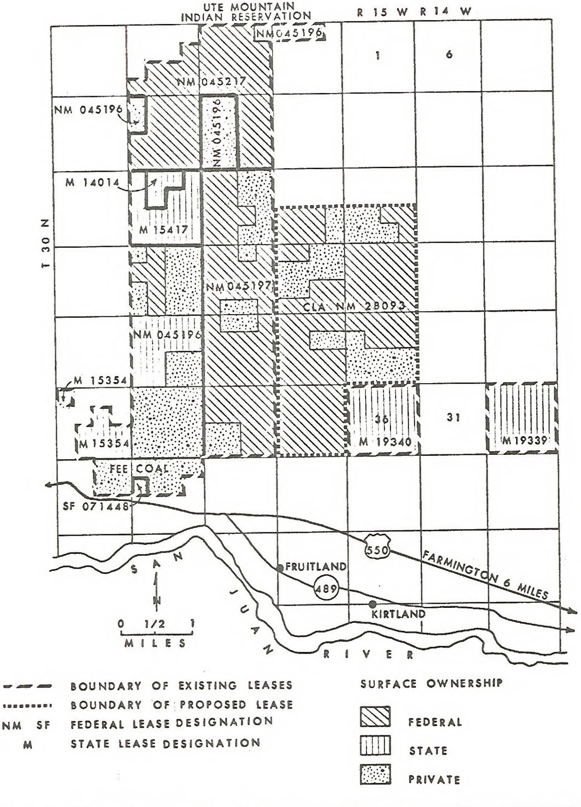
The proposed action being evaluated is the offering for competitive lease of approximately 147 million tons of Federally owned coal contained in two seams in the Fruitland Formation in T. 30 N., R. 15 W., NMPM, Sec. 13: S $^1/_2$, Sec. 14: S$^1/_2$, Sec. 23, 24, 25, 26, and 35. The Federal Government owns and manages these coal resources. Surface ownership to 2,815 of these acres is held by the Federal Government, while ownership of the remaining 1,040 acres of surface (27 percent) is private (see Map I-2).

Impact assessment is based on underground mining of coal in the proposed lease area. No detailed mining and reclamation plan has been developed that shows exact methods or rates for removal of this coal. In accordance with Federal regulations, an applicant has up to 3 years after lease issuance to submit an acceptable mining and reclamation plan for approval. Therefore, preliminary mining information supplied by Western (1979a, b, c) is being used as a model for impact assessment. The use of this information does not indicate a preference on the part of BLM, since the lease is open to competitive bid.

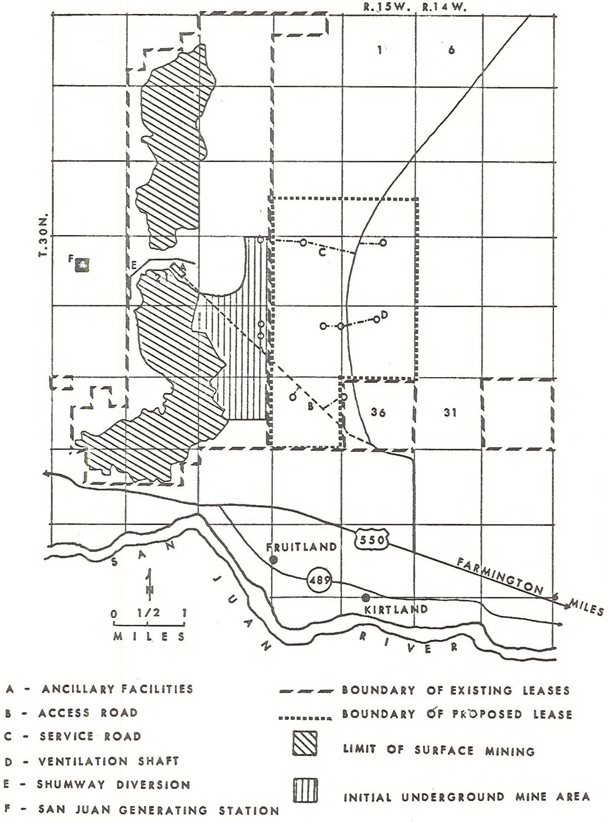
Exploratory drilling would begin soon after acquisition of the lease. Drilling would be done by truck-mounted rotary drills capable of reaching a depth of 1,500 feet. All drill holes would be *geophysically logged* and every third or fourth hole would be continuously cored to determine coal quality. Field operations associated with exploration probably would require 90 to 120 days for completion.

MAP I-2

SURFACE OWNERSHIP AND COAL LEASE STATUS



# MAP I-3
# PROPOSED LEASE AREA AND COAL-RELATED DEVELOPMENTS



SOURCE: WESTERN, 1979b

The location and number of drill sites has not been determined. Access to most of the proposed lease area could be gained by truck-mounted drills using existing roads or traveling cross-country. New temporary roads would be needed for potential drill sites in rough terrain.

Coal mined from the proposed lease area would be processed and transported by facilities that Western plans to build for the underground mine on their current holdings. Seven additional ventilation shafts (labeled "D" on Map I-3) would be needed for the concurrent mining of coal from the proposed lease area. Six of these shafts would be located on the proposed lease area, and one would be located on Western's existing state lease in section 36 (see Map I-3).

There would be no additional mining equipment or employees needed to mine coal from the proposed lease area above that needed to mine coal by underground means from Western's current leases (see Chapter II, Section A). Continuous mining equipment would be used in a *room-and-pillar configuration* that could be converted to *longwall mining*. Diesel equipment would be utilized as much as possible to enhance operating flexibility, productivity, and economics. Safety pillars would be left in place during mining to minimize subsidence. Possible eventual removal of the pillars would be determined at a later time.

Coal production rates from an underground mine on the existing leases and the proposed lease area are shown in Table I-2. If mining began in 1980, the mine would reach a production rate of 2 million tons per year by 1984, and production would continue at this rate for the life of the mine. At the time of abandonment, which may occur about the year 2015, mine facilities would be removed and reclamation achieved, as required by applicable laws and regulations.

### 2. No-Action Alternative

Under this alternative no lease would be issued in response to CLA NM 28093 and the coal reserves within the area for which the CLA was filed would not be mined.

### 3. Other-Owner Alternative

Bidding for the coal in the proposed lease area must be competitive. Therefore, the highest bidder could be someone other than Western. The person or company that obtained the lease would be required to submit an acceptable mining and reclamation plan within three years of lease issuance. Since possible bidders on CLA NM 28093 cannot be identified, impact assessment for this alternative is based on the same mining methods, types of equipment, and number of employees as the proposed action.

Six ventilation shafts and 2.3 miles of service roads are estimated for this alternative. Exploratory drill pads, ventilation shafts, and roadways would occupy about 29 acres on the proposed lease area. A mine portal, coal processing facilities, and mine support facilities also would be needed. These would occupy an estimated 20 acres.

The market and method of transportation for coal produced under this alternative are undetermined. The San Juan Generating Station is the nearest potential user. If marketing agreements were reached to use this coal at the generating station, it is assumed that the coal would be transported about 1 mile by conveyor to Western's facilities. If the coal was not marketed locally, an estimated minimum of 234 trucks and drivers would be needed to transport the coal about 112 miles to the nearest rail line near Gallup, New Mexico.

### 4. Delay-the-Action Alternative

Under this alternative the coal reserves would not be offered for competitive lease bidding until after completion of the planned San Juan River Regional Coal Leasing Environmental Impact Statement. This statement is scheduled to be completed in September 1981, after which lease sale decisions would be made. If this alternative is selected, issuance of the lease would be delayed until some time after mid-February 1982.

Lease bidding would be competitive under this alternative. The highest bidder could be Western or another mining company. If Western was the successful bidder, the coal would be mined as described for the proposed action. If another company was the successful bidder, the coal would be mined as described for the other-owner alternative. However, mining would start approximately $2^1/_2$ years later than in these alternatives.

### 5. Surface-Mining Alternative

Surface mining of these coal reserves is not being considered as a reasonable alternative. The depth of the coal ranges from 325 to 700 feet, which is too deep for removal by surface mining techniques.

## C. Required Mitigation and Comparison of Impacts

Table I-3 identifies relevant laws and regulations and summarizes the ways in which they would mitigate impacts from the proposed action and other alternatives. Table I-4 compares the environmental impacts of the proposed action with those of the other alternatives.

## D. Federal Coal Management Program

Prior to 1970, the Department of the Interior's coal leasing policy was reactive in nature. Lease requests were processed on a case-by-case basis. A 1970 BLM study showed that leased coal acreage on public lands in the western United States was increasing, while production of coal from Federal leases was

## TABLE I-3

## SUMMARY OF MITIGATION

| Resource | Mitigation Required by Law and Regulation | How Mitigation is Accomplished | Additional Mitigation Recommended |
|---|---|---|---|
| Air Quality | P.L. 95-95 | Specifies Federal air quality standards that cannot be violated. | None |
| | New Mexico Air Quality Control Regulation 201 | Specifies standards not to be equalled or exceeded. | |
| | New Mexico Air Quality Standards and Regulation, Section 672 | Coal handling equipment will be equipped to prevent particulate matter from becoming airborne.<br>Haul roads will be sprayed to prevent particulate matter from becoming airborne. | |
| | 30 CFR 817.95 (OSM) | Each underground operator will employ fugitive dust control measures. | |
| | 30 CFR 784.26 (OSM) | Operators will establish monitoring systems for evaluation of dust control programs. | |
| Geologic Setting | 43 CFR 3041.2-2(e) (BLM) | Operators will use mining methods to prevent or control surface subsidence to maintain value and use of surface lands.<br>Disturbed areas will be contoured and regulated after exploration. | None |
| | Dept. of Interior Policy | The Conservation Division of U.S. Geological Survey will determine priority of development between coal, oil, and gas.<br>Future uranium mineral claimants will coordinate with coal lessee. Unresolved conflicts will be settled in court. | |
| Paleontology | 16 U.S.C. 431-433 | Collection of vertebrate fossils prohibited. | All employees and contractors will be advised that removal of fossils is forbidden. |
| | BLM Washington Office Instruction Memorandum 79-111 | Coal mining operations will be monitored and BLM notified if fossils are discovered. | |
| | State of New Mexico Senate Memorial 31 | Mining operators on state lands will notify the State of New Mexico, Dept. of Finance and Administration, Office of Cultural Affairs, if important fossils are found. | |

TABLE I-3 (Cont'd)

| Resource | Mitigation Required by Law and Regulation | How Mitigation is Accomplished | Additional Mitigation Recommended |
|---|---|---|---|
| Soils | 30 CFR 211.40 (USGS) | Roads will be built to minimize erosion and contamination of soil.<br>Drill site and ventilation shafts will be backfilled.<br>Disturbed areas will be regraded and revegetated. | None |
| Water Resources | Clean Water Act of 1977 | Environmental Protection Agency will grant National Pollutant Discharge Elimination System Permits specifying discharge water quality standards. | None |
|  | 30 CFR 817.42 (OSM) | Restricts pollutant discharge. |  |
|  | 30 CFR 817.45, 150-176 (OSM) | Amount of sediment produced will be minimized by conformance. |  |
|  | 30 CFR 817.54 (OSM) | Disrupted water supplies will be replaced. |  |
|  | 30 CFR 817.121 (OSM) | Mining will be conducted to minimize surface damage. |  |
| Vegetation | Federal Surface Mining Control and Reclamation Act of 1977; New Mexico Surface Mining Act of 1979; New Mexico Coal Surface Mining Commission, Rule 78-1, Section 37; 30 CFR 817.111-117 (OSM) | Diverse and permanent vegetative cover capable of self-regeneration at least equal in extent to natural vegetation will be established on affected areas. | None |
| Wildlife | Endangered Species Act of 1973 (87 Stat. 884; 16 U.S.C. 1531-1543, as amended) | Consultation with U.S. Fish and Wildlife Service will take place if endangered species are involved. | Monthly checks on dusk-to-dusk basis will be done to determine the presence or absence of endangered species. Agencies will be contacted if such species are located. |
|  | 30 CFR 817 (OSM) | Required restoration of soils and vegetation allows wildlife to repopulate area upon completion of mining and removal of surface facilities. |  |
| Noise |  | No mitigation possible. | None |

TABLE I-3 (Cont'd)

| Resource | Mitigation Required by Law and Regulation | How Mitigation is Accomplished | Additional Mitigation Recommended |
|---|---|---|---|
| Visual Resources | 30 CFR 211.30 (USGS) | Requires maximum recovery of coal, consistent with protection of other natural resources. | Unless conflicting with safety requirements, surface structures will be painted to blend with dominant color of landscape. |
|  | 30 CFR 211.31(a) (USGS) | Each operator will adopt measures to prevent or control subsidence. |  |
|  | 30 CFR 211.41(c) (USGS) | Methods of abandonment may include regrading and revegetation. Equipment and structures will be removed without delay. |  |
|  | 30 CFR 717.14(a) (OSM) | Disturbed work areas will be regraded to approximate original contour upon completion of mining. |  |
|  | 30 CFR 817.111-117 (OSM) | Specifies revegetation requirements. |  |
| Recreation | 30 CFR 211.4(d) (USGS) | Operator will minimize, control, or prevent damage to recreational values. | None |
|  | 30 CFR 211.40(a)(1) (USGS) | Reclamation will be pursuant to an approved plan to restore pre-mining uses of land. |  |
|  | 30 CFR 211.40(a)(14) (USGS) | Public access on lease area for lawful activities will be allowed, with minor exceptions. |  |
|  | 30 CFR 211.41(c) (USGS) | Excavations will be closed and backfilled in accordance with sound engineering practices. |  |
| Transportation | 30 CFR 817.124 (OSM) | Rights-of-way will be protected. | Lessee will notify rights-of-way holders of operation. Operation will be designed so rights-of-way not affected. Lessee will acquire alternate routes for rights-of-way (to be used if operation disturbs rights-of-way). |

TABLE I-3 (Cont'd)

| Resource | Mitigation Required by Law and Regulation | How Mitigation is Accomplished | Additional Mitigation Recommended |
|---|---|---|---|
| Grazing | 30 CFR 817.111-117 (OSM); New Mexico Coal Surface Mining Commission, Rule 78-1, Section 37 | Diverse and permanent vegetative cover capable of self-regeneration at least equal in extent to natural vegetation will be established on affected areas. | None |
| | 30 CFR 817.13 (OSM) | Exposed underground openings will be managed to ensure safety of people and livestock. | |
| | 30 CFR 817.54 (OSM) | Disrupted water supplies will be replaced. | |
| Wilderness | None necessary | None necessary. | None |
| Land Status | 43 U.S.C. 1712 | Valid existing rights will be identified and protected in BLM land-use plans. | Lessee will notify surface owners and have agreements on current and future land uses, and value, method, and rate of reimbursement for damages.<br>Lessee will document agreements for BLM. |
| Cultural Resources | 16 U.S.C. 431-433; 16 U.S.C. 461-467; 16 U.S.C. 469; 16 U.S.C. 470; 42 U.S.C. 4321 et. seq.; 16 U.S.C. 470; 43 U.S.C. 1701-1771 | It is national policy to protect cultural resources on public land and promote preservation on state and private lands. Federal agencies and/or the State Historic Preservation Officer will identify all sites within a project's potential impact area, evaluate their significance, identify sites eligible for the National Register, and establish mitigation stipulations before clearance is granted. The Advisory Council on Historic Preservation will be provided the chance to comment on any action affecting sites on or eligible for the National Register. | An intensive inventory of sites will be conducted. The mining plan will state that significant sites will be mitigated if endangered by construction or subsidence. Subsidence will be monitored during and after life of the mine, and BLM will be notified if subsidence begins. Site 3434 should be avoided by proposed ventilation shaft. |
| Socioeconomic Conditions | New Mexico Severance Tax Act | Tax of $.38/ton will be paid on steam coal. | None |
| | Mineral Leasing Act of 1920; Coal Leasing Act of 1976 | 50% of royalties from Federal coal will be returned to the state. | None |

TABLE I-4

SUMMARY OF IMPACTS FROM ALTERNATIVES AFTER MITIGATION IS MET

| Resource | Proposed Action | No-Action | Other-Owner | Delay-the-Action |
|---|---|---|---|---|
| Air Quality | 42.8 tons particulates/year for an estimated 22-26 years. | Particulate emissions similar to proposed action.<br>Pollutants of unknown magnitude emitted by haul trucks along unknown routes. | If coal sold locally for San Juan Generating Station, about 45 tons of particulates/year over same time period as proposed action.<br>If coal sold elsewhere, additional exhaust fumes from trucks traveling 112 miles to railhead (71,680 miles/day, 5 days/week).<br>Additional emissions from coal haulage to San Juan Generating Station. | Impacts during delay same as no-action. Impacts after lease issuance same as proposed action or other-owner. |
| Geologic Setting | Possible subsidence of 6-10 feet over 4,504 acres.<br>Surface disturbance and topographic alteration from exploration drill sites.<br>Possible conflict with oil, gas, and uranium development.<br>50-55% coal left underground with room-and-pillar method.<br>About 35% coal left underground with longwall mining. | None | Possible subsidence of 6-10 feet over 3,855 acres.<br>Other impacts same as proposed action. | Impacts same as proposed action or other-owner. |
| Paleontology | Increased unauthorized collection of vertebrate fossils.<br>Possible destruction of currently unknown vertebrate fossils in coal. | Continued natural erosion and unauthorized collection. | Construction would destroy additional, unknown number of sites.<br>Other impacts same as proposed action. | Impacts during delay same as no-action. Impacts after lease issuance same as proposed action or other-owner. |
| Soils | 30 acres of soil disturbed.<br>Possible increased erosion if new roads needed for exploration. | None | 49+ acres disturbed (16 for only first 3 years).<br>Possible increased erosion if new roads needed for exploration. | Impacts same as proposed action or other-owner. |

TABLE I-4 (Cont'd)

| Resource | Proposed Action | No-Action | Other-Owner | Delay-the-Action |
|---|---|---|---|---|
| Water Resources | Possible discharge of ground water into Shumway Arroyo.<br>Sediment movement from disturbed areas would equal about 30 tons/year.<br>Increased channel erosion and destruction of McCabe Dam if subsidence occurred. | None | Ground water inflow slightly less than proposed action.<br>Sediment movement from disturbed areas equalling about 50 tons/year.<br>Other impacts same as proposed action. | Impacts same as proposed action or other-owner. |
| Vegetation | About 14 acres of grassland destroyed during mine operations.<br>Possible destruction of additional 16 acres of grassland during exploration activities. | None | About 49 acres of grassland destroyed. | Impacts same as proposed action or other-owner. |
| Wildlife | Alteration of wildlife diversity, density, and habitat utilization.<br>Increased human activities could inhibit habitation and feeding by endangered and threatened species. Illegal shooting possible. Additional stress or elimination of prairie dog towns would adversely affect any dependent black-footed ferret populations.<br>Abandonment and reclamation would have beneficial effect on wildlife. | Mortality of smaller species increased by 160+ trucks/day hauling coal to San Juan Generating Station. | Increased displacement of larger species by additional construction.<br>Increased mortality of smaller species by vehicular traffic.<br>Other impacts same as proposed action. | Impacts during delay same as no-action. Impacts after lease issuance same as proposed action or other-owner. |

TABLE I-4 (Cont'd)

| Resource | Proposed Action | No-Action | Other-Owner | Delay-the-Action |
|---|---|---|---|---|
| Noise | Noise levels expected to increase during all phases of development.<br>Increased noise could be disruptive to wildlife. | Noise levels increased by 160+ trucks/day hauling coal to San Juan Generating Station. | Coal not sold to Western for San Juan Generating Station would be hauled 112 miles to railhead for shipment to another market (219-320 round trips/day). Additional noise produced.<br>San Juan Generating Station needs would require Western to haul in 160+ trucks/day for 4 years, beginning in 1982. Additional noise produced.<br>Other impacts same as proposed action. | Impacts during delay same as no-action. Impacts after lease issuance same as proposed action or other-owner. |
| Visual Resources | Modifications would attract attention but not dominate landscape, appearing as extensions of mining activities on adjacent leases. | Negative influence from mining on adjacent leases. | Additional ancillary facilities would modify landscape. Other impacts same as proposed action. | Impacts during delay same as no-action. Impacts after lease issuance same as proposed action or other-owner. |
| Recreation | Six acres of land removed from recreation use by ventilation shafts and equipment.<br>24 acres converted from open land to roads. | None | Five acres removed from recreation use.<br>Other impacts same as proposed action. | Impacts same as proposed action or other-owner. |
| Transportation | Continued traffic on County Road 61, N.M. 489, and U.S. 550.<br>Traffic fatalities increased by approximately 13.66/100 million miles driven for mining operations.<br>Assuming 6-10 feet subsidence, area unsuitable for road and current rights-of-way uses. | Additional 160+ coal haul trucks/day to San Juan Generating Station.<br>Additional fuel required by haul trucks. | Coal not sold to Western for San Juan Generating Station would be hauled 112 miles to railhead for shipment to another market (219-320 round trips/day).<br>San Juan Generating Station needs would require Western to haul in 160+ trucks/day for 4 years, beginning in 1982.<br>Additional fuel required by haul trucks.<br>Other impacts same as proposed action. | Impacts during delay same as no-action. Impacts after lease issuance same as proposed action or other-owner. |

TABLE I-4 (Cont'd)

| Resources | Proposed Action | No-Action | Other-Owner | Delay-the-Action |
|---|---|---|---|---|
| Grazing | 2-4 AUMs lost.<br>Possible livestock harassment. | None | 4-6 AUMs lost.<br>Possible livestock harassment. | Impacts same as proposed action or other-owner. |
| Land Status | Future surface uses of Federal land limited. | None | Impacts same as proposed action. | Impacts same as proposed action or other-owner. |
| Cultural Resources | Archeological sites at drill holes, roads, and ventilation shafts destroyed.<br>Assuming 6-10 feet subsidence, destruction of all 69 estimated sites.<br>Increased unauthorized collection. | Continued natural erosion and unauthorized collection. | Construction could destroy one additional site.<br>Assuming 6-10 feet subsidence, destruction of approximately 59 sites.<br>Other impacts same as proposed action. | Impacts during delay same as no-action. Impacts after lease issuance same as proposed action or other-owner. |
| Socioeconomic Conditions | Tax revenues to State of New Mexico, with possible allocation to San Juan County.<br>Royalties to Federal Government and state.<br>Economic situation for some families improved, others relatively poorer.<br>Possible inflationary increases in local prices of goods and services.<br>Unemployment in county may rise slightly for short period.<br>Unquantifiable additional strain on value systems and traditions of native population.<br>Relatively small additional demands on infrastructure. | Unquantifiable loss of workers from San Juan County.<br>Loss of tax revenues to State of New Mexico.<br>Loss of royalties to Federal government and state.<br>Loss of revenues to state from not mining Section 36. | Possible operation of two underground mines may increase population and employment for about 14 years, placing additional demands on infrastructure.<br>Probable increase in cost of electric rates.<br>Loss of tax revenues to State of New Mexico.<br>Loss of royalties to Federal government and state.<br>Loss of revenues to state from not mining Section 36.<br>Other impacts same as proposed action. | Impacts during delay same as no-action. Impacts after lease issuance same as proposed action or other-owner. |

decreasing. In 1971, the Secretary of the Interior directed BLM to halt the issuance of coal leases and prospecting permits.

The moratorium was replaced in February 1973 with a new coal leasing policy that embodied both short-term and long-term leases. New short-term leases were issued only to maintain existing mines or to supply reserves for production in the near future. In September 1975, the new long-term leasing policy of the Department of the Interior was presented in a final programmatic environmental impact statement (U.S. Dept. of Interior, Bureau of Land Management, 1975a). In August 1976, the Department's authority to issue prospecting permits was repealed.

On September 27, 1977, the U.S. District Court for the District of Columbia ruled in the case National Resources Defense Council, Inc., et al. v. Royston C. Hughes, et al. (NRDC v. Hughes; Civil Action 75-1749) that the environmental impact statement was inadequate and enjoined the Department of the Interior from implementing the new coal leasing program. On June 14, 1978, the District Court issued a modified order permitting issuance of leases under certain specific conditions. Western's CLA NM 28093 is listed in the modified order as eligible to receive further processing.

The Department of the Interior has announced a new Federal coal management program. This program is the preferred alternative set out in the Final Environmental Statement, Federal Coal Management Program, released in April 1979 (U.S. Dept. of Interior, Bureau of Land Management, 1979a). New regulations provide for a long-term leasing program, as well as an emergency leasing program incorporating the specific lease applications, including this lease application, that are cited in the NRDC v. Hughes modified order.

## E. Legislative and Regulatory Authorizations

The principal authorities that allow the leasing and development of Federal coal lands include the following laws and regulations:

### Laws

- Mineral Leasing Act of 1920, as amended
- Federal Coal Leasing Amendments Act of 1976
- Federal Land Policy and Management Act of 1976
- Surface Mining Control and Reclamation Act of 1977

### Regulations

- 43 CFR 3400
- 30 CFR 211
- 30 CFR 700-890

The specific regulation authorizing this emergency lease proposal is 43 CFR 3425.

## F. Land-Use Planning

The proposed lease area is in the BLM San Juan Planning Unit. A Management Framework Plan approved by BLM in June, 1974 identifies coal development as a land-use activity that is compatible with other activities in this planning unit. The coal reserves of the proposed lease area are identified as a resource management opportunity in the BLM San Juan Unit Resource Analysis (currently being revised). No other Federal, state, or local land-use plans address coal development in the proposed lease area.

The San Juan County Planning Commission has developed a land-use plan for a portion of the county. This plan does not cover the proposed lease area. Issuance of CLA NM 28093 for the purposes of mining would not conflict with county land-use policies.

## G. Agency Roles

The roles of various governmental agencies in coal development are shown in Appendix A. There are many Federal agencies involved in the management of coal, but agencies of the Departments of Energy and Interior bear primary responsibility. The Department of Energy coordinates energy research and regulates the use of coal. The Department of the Interior assesses and manages coal resources. The State of New Mexico must approve all coal mines within the boundaries of the state. Jurisdiction covers surface mines and the surface effects of underground mines.

# CHAPTER II

# AFFECTED ENVIRONMENT

# CHAPTER II

## AFFECTED ENVIRONMENT

### A. Underground Mine Development on Existing Leases

The following is a description, based on preliminary information, of developments that Western is planning for their existing leases. Western will construct an underground mine portal in T. 30 N., R. 15 W., NMPM, Sec. 21: SE$^1/_4$ to remove coal from a portion of their current lease holdings. In preparation for portal development, coal will be removed by surface mining methods from an area beginning near the center of Section 21 and running southeasterly. This will result in an open pit, with a highwall exposing the coal seam to be mined by underground methods. The portal will be developed in this highwall. Three ventilation shafts (labeled "D" on Map I-3) will be constructed on the present lease area, using existing roads where possible. Main haulage ways will be developed after portal facilities are established.

Coal removed from the underground mine will be transported by overland conveyor to a secondary crusher near the San Juan Generating Station. Ancillary facilities (labeled "A" on Map I-3) will be located approximately one-half mile northwest of the portal. This complex will include an office, changehouse, warehouse, parking lot, shop, and storage yard. Figure II-1 shows relative locations of these facilities. A proposed access road (labeled "B" on Map I-3) would connect this complex with an existing road in Section 36.

Underground coal production from Western's existing lease is anticipated to begin in the third quarter of 1980, and reach full production at the end of the fifth year of operation (1986). As currently projected, the estimated yearly rates of production for the first 5 years of operation will be:

| | |
|---|---|
| Year 1 | 283,700 tons |
| Year 2 | 352,000 tons |
| Year 3 | 676,200 tons |
| Year 4 | 1,671,200 tons |
| Year 5 | 2,000,000 tons |

Estimated recoverable reserves show that a maximum 21 million tons of coal could be mined from this lease. Mining at the projected rates will exhaust these reserves by the end of 1994.

By the time full production in the mine is reached, the following equipment and other requirements will be needed:

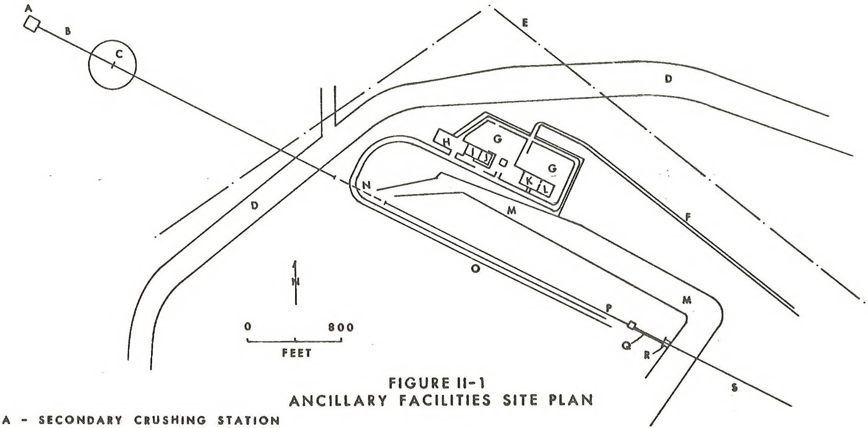


FIGURE II-1
ANCILLARY FACILITIES SITE PLAN

A - SECONDARY CRUSHING STATION
B - RECLAIM CONVEYOR
C - STORAGE PILE
D - SHUMWAY DIVERSION
E - UTILITY LINE
F - ACCESS ROAD
G - PARKING

H - STORAGE
I - WAREHOUSE
J - SHOP
K - CHANGEHOUSE
L - OFFICE
M - HIGHWALL

N - CROSSING TUNNEL
O - PIT ROAD
P - OVERLAND CONVEYOR
Q - MINE CONVEYOR
R - PORTAL
S - AUXILARY STOCKPILE CONVEYOR

SOURCE: AFTER WESTERN, 1979b

## Mine Equipment

| | |
|---|---|
| Continuous Miners | 10 |
| Shuttle Cars | 22 |
| Roof Bolters | 10 |
| Load-Haul-Dump Units | 10 |
| Personnel Carriers | 12 |
| Power Centers | 10 |
| Belt Feeders | 10 |
| Section Ventilation Fans | 11 |
| Rock Dust Distributors | 11 |
| Fuel and Lubrication Trucks | 3 |
| Rock Haulage Trucks | 3 |
| Front End Loaders | 2 |
| Main Ventilation Fans | 2 |
| Rock Dusters | 2 |
| Fork Lifts | 3 |
| Supply Trucks | 5 |
| Road Graders | 2 |
| Management Vehicles | 11 |
| Conveyor Power Centers | 24 |
| Conveyor Belts | |
| 48 in. wide | 19,800 ft. |
| 36 in. wide | 33,000 ft. |

## Manpower Requirements

| | |
|---|---|
| Surface | 76 |
| Underground | 316 |
| Total | 392 |

## Electrical Requirements

Connected Horsepower - 5,000
Available kva - 7,500

## Fuel Requirements

Diesel (gal/yr) - 500,000

According to Western, this additional equipment and other requirements will be added even if the company does not get the proposed lease.

Western has indicated that any delay in the development of their deep mine will necessitate the company's entry into the spot market by 1982 for up to one million annual tons of truck-delivered coal. This coal presumably will come from existing production in either Colorado or Utah, and will result in 160 or more individual truckloads per day to the San Juan Mine. Each truck will travel at least 200 miles over mountainous terrain to make its delivery.

## B. Resource Components of the Affected Environment

### 1. Climate

The climate of the area is best characterized as semi-arid steppe. The semi-arid nature contributes to large ranges in temperature during the course of a day. The mean maximum temperature is about 67°F and the mean minimum is about 35°F. The hottest month is July, when temperatures may be as high as the upper 90's, and the coldest month is January, when temperatures as low as -5° may occur. The last spring frost normally is in early May and the first fall frost in mid-October. This results in a growing season of about 160 days.

The average annual precipitation at the proposed lease area is about 8.8 inches. Only minor variations in precipitation result from differences in surface elevation. The wettest period of the year is from July through October. August is the wettest month, with an average precipitation of 1.5 inches. The driest month is November, when an average of about 0.4 inches of precipitation occurs. The average annual snowfall is about 24 inches, with the greatest monthly amount in December or January. The average *pan evaporation* on the proposed lease area is about 64 inches per year.

The prevailing wind direction is west to southwesterly. The strongest winds are during the spring and the lightest winds during the winter. A combination of low *mixing heights* and light *transport winds* occasionally occurs in the area, causing periods of poor dispersion. These episodes are most frequent during the winter, but also may occur during the summer and fall.

### 2. Air Quality

The air quality of the general region that includes the proposed lease area is discussed in the Star Lake-Bisti Regional Coal Environmental Statement (U.S. Dept. of Interior, Bureau of Land Management, 1979b). Available data from the nearby monitoring stations in Kirtland and at the El Paso Natural Gas Plant best characterize the air quality at the proposed lease site. Summaries of these data show that concentrations of sulfur dioxide and oxides of nitrogen are well below the Federal and New Mexico Air Quality Standards for all averaging periods. Concentrations of total suspended particulates (TSP) are more variable and do, at times, exceed the standards. Table II-1 summarizes the TSP concentrations measured at these monitoring stations and compares them to Federal and New Mexico standards.

## TABLE II-1

## TOTAL SUSPENDED PARTICULATE CONCENTRATIONS

| Monitoring Station | Date | Concentrations (mg/m$^3$) Annual Geometric Mean | Highest 24-Hour | 2nd Highest 24-Hour |
|---|---|---|---|---|
| Kirtland | 1975 | 31.7 | 136.4 | - |
| | 1976 | 80.9 | 219.0 | - |
| | 1977 | 47.2 | 289.8 | 228.9 |
| | 1978 | 47.0 | 142 | 141 |
| EPNG[1/] | 1975 | 37.3 | 83.8 | - |
| | 1976 | 68.8 | 275.3 | - |
| | 1977 | 53.0 | 289.3 | 204.4 |
| | 1978 | 45.0 | 191 | 128 |
| Federal Primary Standards | | 75 | 260[2/] | |
| Federal Secondary Standards | | 60 | 150[2/] | |
| New Mexico Standards [3/] | | 60 | 150 | |

---

[1/] El Paso Natural Gas Plant

[2/] Concentrations not to be exceeded more than once per year.

[3/] Concentrations not to be equaled or exceeded.

## 3. Geologic Setting

### a. Topography

The proposed lease area is located in the Navajo section of the Colorado Plateau Physiographic Province. This section is characterized by moderately dissected scarped plateaus (see Map II-1). The area is one of low relief except for mesas at the south end of Section 35 near the eastern end of Sections 13, 24, and 25. The highest point on the proposed lease is 5,573 ft. in SE$^1/_4$ Sec. 24. The lowest point is 5,220 ft. in the SW$^1/_4$ Sec. 26, providing a relief of 353 ft. Away from the mesas, the land slopes gently in a westerly southwesterly direction about 1° to 2°.

### b. Stratigraphy

The proposed lease area is underlaid by the Kirtland Shale and Fruitland Formations, both of Cretaceous age (Fassett and Hinds, 1971).

The Kirtland Shale Formation has been divided into two units, with a total thickness ranging up to 1,500 ft. The upper unit consists of the upper shale member and the Farmington Sandstone member. The lower unit consists of the lower shale member. Little coal or carbonaceous shale is present in the Kirtland Shale.

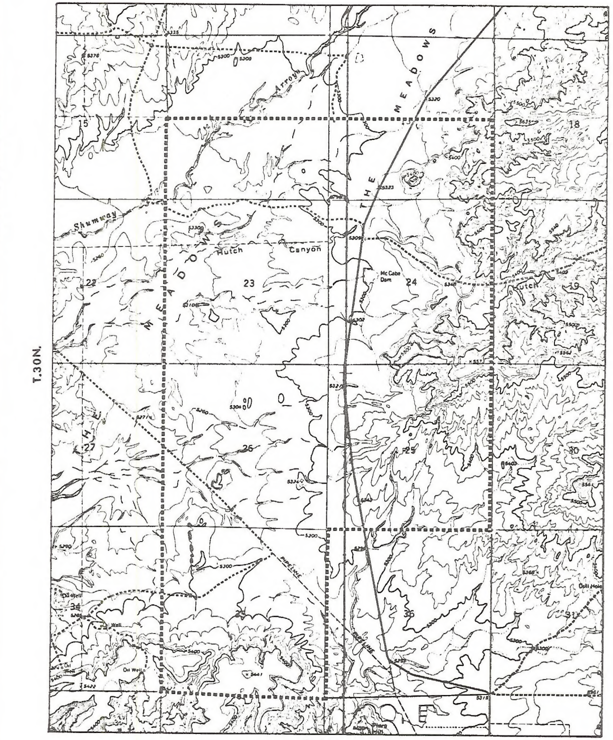
The Fruitland Formation is composed of interbedded sandstone, siltstone, shale, carbonaceous shale, carbonaceous sandstone and siltstone, coal, and some thin limestone beds. Thickness ranges up to 500 feet.

The Fruitland Formation contains two main coal seams in this area. The lower seam averages 15.3 feet thick in the 24 holes drilled by the U.S. Geological Survey. In 13 of the 24 holes, a 2 to 3 foot rider seam is present 3 to 11 feet above the lower seam. Current production in the San Juan mine is from the lower seam. A thinner seam is located approximately 100 feet above the lower seam. This seam averages 6.3 feet thick. The overburden above the lower seam ranges from 325 feet at the west end of the proposed lease area to 700 feet at the east end. The coal has a *Btu* content ranging from 9,000 to 10,000, giving it a *rank* of subbituminous C to subbituminous B. The sulfur content of the coal is approximately 0.8 percent, making it a relatively low sulfur coal. Total reserves in the lower seam are 104,396,370 tons and reserves in the upper seam are 42,987,105 tons. This bed is located in the San Juan Known Recoverable Coal Resource Area (*KRCRA*).

### c. Structure

The proposed lease area lies near the western boundary of the San Juan Basin. The basin is asymmetric and characterized by an irregular northeast-trending axis lying about

# MAP II-1
## TOPOGRAPHY



SOURCE: USGS 1:24000 SERIES YOUNGS LAKE, WATERFLOW QUADS.

10 miles east of the proposed lease area. About 5 miles west of the area is the Hogback Monocline, where sedimentary layers have been upturned.

No known faults are found on the proposed lease area. Any faults that may be discovered by mining operations would probably be discontinuous and have displacements of no more than a few feet. The underlying sedimentary layers dip gently 1° to 3° to the southeast towards the basin axis.

### d. Geologic Hazards

No landslides were found in an inspection of the proposed lease area. The earthquake potential is low since no known faults are present. The only localities with a slight landslide or rockslide potential are the mesas on the eastern and southern borders of the area. If the coal is mined by the longwall method, projected subsidence of 6 to 10 feet could occur.

### e. Non-Coal Mineral Resources

Other than coal, oil and gas would be the most likely mineral resources found on the proposed lease area. Formations in the area that are significant producers of oil and gas are the Farmington Sandstone member of the Kirtland Shale, Pictured Cliffs, Cliff House and Point Lookout Sandstones, Mancos Shale, and Dakota Sandstone, all of Late Cretaceous age, the Hermosa and Paradox Formations of Pennsylvanian age, and the Ouray Limestone of Devonian age. These formations are at much greater depth than the coal seams. Most drilling in the region has been for targets that are relatively easy to identify, such as structural traps. Several producing oil and gas wells are within 1 mile of the proposed lease area. The nearest field producing commercial quantities of oil is the Verde Field, about 4 miles to the northwest. The nearest gas field is about 5 miles to the east. Both of these fields are within Known Geological Structures (*KGS*), although the proposed lease area is not. Possibilities for oil and gas accumulations exist in stratigraphic traps that might underlie this area. These traps probably would not have any surface expression to aid in exploration work.

The following parcels in T. 30 S., R. 15 W. are currently under lease for oil and gas:

Sec. 13, N1/2, N1/2SE1/4, SE1/4SE1/4

Sec. 14, N1/2, SW1/4, N1/2SE1/4, SW1/4SE1/4

Sec. 23, NW1/4, SW1/4SW1/4, N1/2SE1/4

Sec. 24, N1/2, N1/2SW1/4, SE1/4SW1/4, SE1/4

Sec. 25, NE$^1/_4$, E$^1/_2$NW$^1/_4$, SW$^1/_4$NW$^1/_4$

Sec. 26, S$^1/_2$NE$^1/_4$, S$^1/_2$NW$^1/_4$, NW$^1/_4$, S$^1/_2$

None of these parcels are currently in production. It is not known whether or not exploratory activities will occur during the proposed mining activities.

An insignificant amount of low-grade uranium ore has been found at scattered localities in the Fruitland Formation. No mining claims currently exist on the proposed lease area. The Morrison Formation, which lies about 3,000-5,000 feet beneath the surface, contains valuable deposits of uranium in places. Uranium has been deep-mined profitably at other localities.

### 4. Paleontology

The only exposed fossiliferous rocks within the proposed lease area belong to the Upper Cretaceous Kirtland Formation. Two years ago, Kues, et al. (1977) conducted an intensive paleontological survey of the eastern quarter of the proposed lease area where these rocks occur. This survey identified five localities for fossil vertebrates. Fossils recovered from these sites represent poorly preserved bone fragments of dinosaurs, crocodiles, and turtles. All of this material comes from greenish-gray claystones of the upper Kirtland (Kues, et al., 1977). During the survey, the remains of plants and invertebrates were not found within or near the area of the proposed lease. In other parts of the San Juan Basin, the Kirtland Formation does contain abundant, well-preserved remains of plants, invertebrates, and vertebrates.

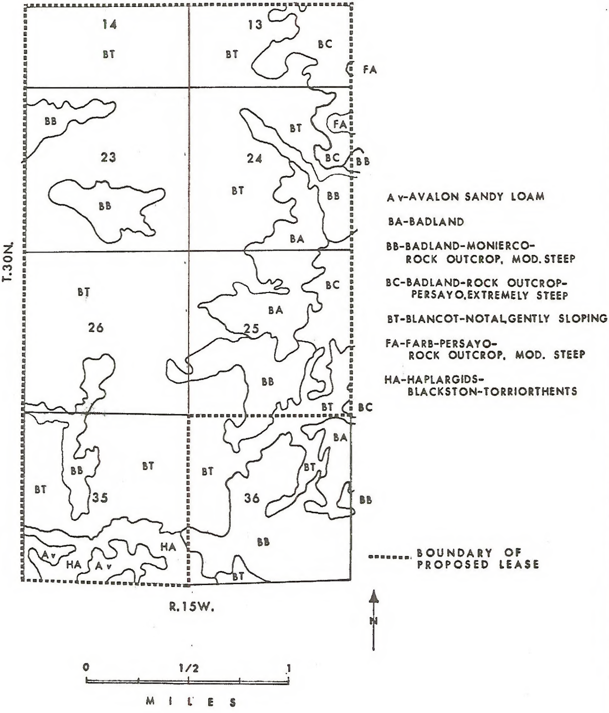
The Fruitland Formation directly underlies the Kirtland Formation in the San Juan Basin. Fruitland strata are also of Upper Cretaceous age. Although this formation contains many fossiliferous rock units, they are entirely subsurface within the boundaries of the proposed lease area. Most fossil-bearing rocks of this formation occur in close association with coal beds. South and west of the proposed lease area, Fruitland exposures yield well-preserved remains of dinosaurs, crocodiles, turtles, fish, bivalves, gastropods, and plants. No doubt the same kinds of fossils occur within subsurface strata of the Fruitland.

Appendix B of Star Lake-Bisti Regional Coal (U.S. Dept. of Interior, Bureau of Land Management, 1979b) lists all known fossil taxa from the Fruitland and Kirtland Formations in the San Juan Basin.

### 5. Soils

The soils inventory and research data were supplied by the Soil Conservation Service (U.S. Dept. of Agriculture, 1977b). Soils depicted in Map II-2 were grouped

## MAP II-2
## SOIL MAPPING UNITS


14
13
BT
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23
24
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BA
T.30N.
BT
26
BC
BA
25
BB
BT
BC
BA
BB
BT
BT
BT
BT
BB
35
36
BB
HA
Av
HA
Av
BT
R.15W.
Av-AVALON SANDY LOAM
BA-BADLAND
BB-BADLAND-MONIERCO-ROCK OUTCROP, MOD. STEEP
BC-BADLAND-ROCK OUTCROP-PERSAYO, EXTREMELY STEEP
BT-BLANCOT-NOTAL, GENTLY SLOPING
FA-FARB-PERSAYO-ROCK OUTCROP, MOD. STEEP
HA-HAPLARGIDS-BLACKSTON-TORRIORTHENTS
BOUNDARY OF PROPOSED LEASE
N
0
1/2
1
MILES

SOURCE: U.S. DEPT. OF AGRICULTURE, 1977b.

together according to their similar characteristics and delineated on aerial photographs. Soil characteristics were checked to a depth of 5 feet unless bedrock was encountered before that depth. The delineated areas are referred to as "Soil Mapping Units." The two major soil mapping units in the proposed lease area, BT and BB, are discussed in the following paragraphs. The remaining soil mapping units are explained in detail in Appendix B.

The soil group with the greatest acreage is the BT association. These soils occur on nearly level to gently sloping areas on alluvial fans and valley bottoms. They are deep, well-drained soils formed from water deposited sediments. Typically the surface layers range from a loam to clay loam, and the subsoil ranges from a clay loam to a clay. Permeability is moderately slow to slow. The available water capacity is high. The effective rooting depth is 60 inches. Surface runoff is medium and erosion hazard is high. The soil blowing hazard is moderate.

The BB association occurs on nearly level to moderately steep areas on knolls, ridges, plains, hills and breaks. Where there is soil, it is shallow to bedrock. The soils formed from blown material, water deposited sediment, and in place from the natural weathering process. Soil textures vary considerably. Permeability is moderately slow. The available water capacity is very low. Effective rooting depth is 12 inches when there is soil. Surface runoff is medium to high and erosion hazard is moderate to high. The soil blowing hazard is high.

Reclamation potential on the several soils that occur on the proposed lease area range from very good to very poor. Since only small isolated surface areas would be disturbed, topsoil could be brought in to reclaim any disturbed areas with poor reclamation potential.

## 6. Water Resources

### a. Ground Water

Limited amounts of ground water occur in the proposed lease area. Ground water occurs in the Fruitland coal, the overburden, the underlying Pictured Cliffs Sandstone, and deeper bedrock aquifers that should be unaffected by coal mining. Ground water flows downdip to the east from areas of outcrop west of the proposed lease area.

A number of test wells have been drilled in and adjacent to the proposed lease area to determine *hydraulic characteristics* of the aquifers and the quality of underground water. Well test data indicate that all affected formations are poor aquifers due to low *transmissivities* and poor water quality. The Fruitland coal is a better aquifer than the overlying and underlying formations; however, even the coal seam has a poor ability to transmit water. There are no present uses of ground water in the proposed lease area, but there is one abandoned well near the northern boundary of the lease (see Map II-3).

### b. Ground Water Quality

Each of the test wells drilled in the proposed lease area was sampled by the U.S. Geological Survey in 1978 to determine water quality. Table II-2 summarizes the existing ground water quality in the overburden, the coal, and the underlying Pictured Cliffs Sandstone. Data indicate that ground water is of marginal quality for livestock watering due to high concentrations of chlorides, and unsuitable for irrigation due to high sodium and salinity hazards.

All three strata contain water that is high in sodium chloride. In addition, the deeper Pictured Cliffs Formation contains substantial concentrations of dissolved sulfate. Water in the overburden has an unusually high pH, with correspondingly high carbonate and hydroxide alkalinity.

### c. Surface Water

As shown on Map II-1, the proposed lease area is drained by Shumway Arroyo, an ephemeral tributary of the San Juan River. Drainage in the lease area is from areas of outcrops and badlands on the east side of the tract to lower areas near Shumway Arroyo on the west side. Runoff from badlands is contained in well-defined, sandy-bottom channels, which spread out and lose their definition as they enter the gently sloping land in the center of the proposed lease area. Further west a series of tributaries to Shumway Arroyo have headcut their way into this gently sloping area and are deeply entrenched in the northwest corner.

Total runoff from the proposed lease area is estimated at 50 to 55 acre feet per year (about 0.17 inches over the entire proposed lease area). Most of this runoff occurs during the summer months in response to local, intense storm events.

McCabe's Dam is the one major impoundment of surface water in the proposed lease area (see Map II-1). McCabe's Dam impounds approximately 5 to 8 acre-feet of water on 2 to 3 surface acres. The actual volume fluctuates with storm events. This impoundment is used for livestock watering.

### d. Surface Water Quality

Limited data exist on the quality of surface water in the proposed lease area. U.S. Geological Survey data indicate that ephemeral flows in Shumway Arroyo and Hutch Canyon contain very high concentrations of suspended sediment with surface water quality predominately of the sodium-bicarbonate/sodium-sulfate type (U.S. Dept. of Interior, 1976-1978). U.S. Geological Survey data also indicate that water in McCabe's Dam is of the

TABLE II-2

GROUND WATER RESOURCES IN THE PROPOSED LEASE AREA

| Aquifer<br>Transmissivity (gpd/Ft)<br>Storage Coefficient | | Overburden<br>0.2<br>----- | | Coal<br>4.5-134<br>$10^{-5}$ to $4.2 \times 10^{-4}$ | Pictured Cliffs<br>5.1<br>----- | |
|---|---|---|---|---|---|---|
| Parameter | Units | 2/22/78 | 5/23/78 | 2/22/78 | 2/21/78 | 5/23/78 |
| Alkalinity, Total (as $CaCO_3$) | mg/l | 1,580 | 1,300 | 1,210 | 200 | 460 |
| Arsenic, Dissolved | ug/l | 0 | 2 | 0 | 0 | 1 |
| Barium, Dissolved | ug/l | 200 | 400 | 200 | 100 | 300 |
| Bicarbonate | mg/l | 0 | 0 | 1,480 | 248 | 564 |
| Boron, Dissolved | ug/l | 150 | 180 | 1,100 | 490 | 960 |
| Cadmium, Dissolved | ug/l | 1 | 1 | 0 | 2 | 1 |
| Calcium, Dissolved | mg/l | 100 | 41 | 12 | 230 | 130 |
| Carbon, Dissolved Organic | mg/l | 39 | 98 | 10 | 180 | 21 |
| Carbonate | mg/l | 171 | 190 | 0 | 0 | 0 |
| Chloride, Dissolved | mg/l | 1,600 | 3,300 | 2,000 | 2,700 | 6,300 |
| Chromium, Dissolved | ug/l | 10 | 0 | 10 | 20 | 15 |
| Cobalt, Dissolved | ug/l | 0 | 0 | 0 | 0 | 0 |
| Copper, Dissolved | ug/l | 2 | 0 | 0 | 0 | 0 |
| Depth (Feet from Surface) | | 582 | - | 715 | 730 | - |
| Depth-Bottom Water Zone | | 582.0 | 582.0 | 715.0 | 730.0 | 730.0 |
| Depth-Top Water Zone | | 546.0 | 546.0 | 590.0 | 613.0 | 613.0 |
| Fluoride, Dissolved | mg/l | 2.2 | 1.7 | 2.4 | 1.8 | 1.4 |
| Hardness, Noncarbonate | mg/l | 0 | 0 | 0 | 620 | 56 |
| Hardness, Total | mg/l | 250 | 110 | 46 | 820 | 520 |
| Hydroxide | mg/l | 440 | 335 | - | - | - |
| Iron, Dissolved | ug/l | 10 | 0 | 90 | 10 | 0 |
| Lead, Dissolved | ug/l | 1 | 3 | 0 | 5 | 6 |
| Lithium, Dissolved | ug/l | 110 | 130 | 140 | 220 | 390 |
| Mangesium, Dissolved | mg/l | 0.0 | 0.3 | 3.6 | 58 | 45 |
| Manganese, Dissolved | ug/l | 0 | 5 | 10 | 80 | 100 |
| Mercury, Dissolved | ug/l | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| $NO_2$+$NO_3$, As Dissolved N | mg/l | 0.09 | 0.07 | 0.04 | 0.01 | 0.03 |
| pH-Field | | 12.0 | 11.9 | 8.1 | 8.1 | 8.1 |
| pH-Lab | | 12.4 | 11.8 | 8.0 | 7.4 | 8.0 |
| Phosphate, Ortho, Dissolved as P | mg/l | 0.06 | 0.08 | 0.01 | 0.16 | 0.03 |
| Phosphate, Dissolved Ortho | mg/l | 0.18 | 0.25 | 0.03 | 0.49 | 0.09 |
| Potassium, Dissolved | mg/l | 24 | 25 | 7.4 | 20 | 30 |
| Residue, Dissolved Calc. Sum | mg/l | 5,230 | 7,100 | 4,930 | 6,750 | 12,200 |
| Residue, Dissolved | Tons/AFT | 7.11 | 9.91 | 6.70 | 9.18 | 16.5 |
| SAR | | 55 | 124 | 130 | 32 | 85 |
| Selenium, Dissolved | ug/l | 5 | 4 | 0 | 0 | 0 |
| Silica, Dissolved | mg/l | 11 | 13 | 11 | 15 | 12 |
| Sodium, Dissolved | mg/l | 2,000 | 2,900 | 2,000 | 2,100 | 4,400 |
| Sodium, Percent | | 94 | 98 | 99 | 85 | 95 |
| Specific Conductance, Field | umhos | 13,000 | 16,000 | 8,800 | 11,000 | 19,000 |
| Specific Conductance, Lab | umhos | 12,195 | 14,546 | - | 10,839 | 19,400 |
| Strontium, Dissolved | ug/l | 1,600 | 2,400 | 1,000 | 4,600 | 7,700 |
| Sulfate, Dissolved | mg/l | 880 | 290 | 160 | 1,500 | 1,000 |
| Sulfide, Total | mg/l | 160 | 26 | 14 | 2.7 | 0.3 |
| Uranium, Dissolved | ug/l | 0.4 | 0.6 | 0.4 | 1.7 | 0.6 |
| Water Temperature | Deg. C | 17 | 18 | 18 | 15 | 16 |
| Zinc, Dissolved | ug/l | - | 20 | - | - | 1,100 |

Source: U.S. Dept. of Interior, U.S. Geological Survey, 1978.

sodium-bicarbonate/sodium-sulfate type (U.S. Dept. of Interior, 1975). Total dissolved solids of this water was measured at 1,050 milligrams per liter, well within recommended levels for livestock watering. Other chemical components also were within recommended levels for livestock waters (National Academies of Science and Engineering, 1972).

#### e. Sediment

The amount of soil lost to erosion each year was calculated with the Universal Soil Loss Equation (*USLE*), as applied to mining activities in the western United States (U.S. Dept. of Agriculture, Soil Conservation Service, 1977a). Erosion estimates were made separately for the badland/outcrop area on the east side of the proposed lease area. Estimated erosion on 780 acres of badlands and outcrops is 45 tons/acre/year, or 35,100 tons per year from the entire badland/outcrop area. Most of this sediment is deposited on the gentle slope in the center of the proposed lease area, where stream channels leave the badlands. Estimated soil loss from this gently sloping area is 0.63 tons/acre/year, or a total of 1,930 tons. This USLE estimate probably is low, because it does not include channel erosion resulting from gully development in the western portion of the proposed lease area.

### 7. Vegetation

Over 90 percent of the proposed lease area is occupied by the grassland vegetation type, with the remainder occupied by the saltbush-greasewood type. The grassland is characterized by a very little ground cover composed of Indian ricegrass in association with galleta, blue grama, and alkali sacaton. The grasses are interspersed by shadscale, fourwing saltbush, broom snakeweed, and black greasewood shrubs. Major forb species are Russian thistle, globemallow, and various species of buckwheat.

The saltbush-greasewood vegetation type occupies the relatively low-lying areas near the drainageways in the northwestern portion of the proposed lease area. Black greasewood and shadscale are the dominant species. The understory species include alkali sacaton, galleta, and Russian thistle.

The proposed lease area was surveyed for the presence of threatened or endangered plant species by Martin, et al. (1978). No plants were found that are proposed for threatened or endangered status in the Federal Register (Vol. 40, No. 117, July 1, 1975; Vol. 41, No. 127, June 16, 1976), or listed by the New Mexico State Heritage Program as endangered or threatened.

## 8. Wildlife

### a. Characteristic Wildlife Species

Approximately 150 species of terrestrial vertebrate wildlife are either known or are expected to occur in the grass lands characteristic of the proposed lease area and surrounding region (U.S. Dept. of Interior, Bureau of Land Management, 1978a).

Populations of many wildlife species in the region are low. This is especially true where there is excessive human activity, particularly from existing surface mining operations. Installation of pipelines, vehicular traffic, dwellings, poaching, and overgrazing also contribute to low wildlife populations. Due to these facts, the lease area has been cited as having no potential for wildlife habitat management.

Three big-game species, mule deer (Odocoileus hemionus), pronghorn antelope (Antilocapra americana), and elk (Cervus canadensis) are known to utilize this region at various periods. In 1978, the average population of deer per section in the region was computed to be 11.3, but this figure is considerably lower in the proposed lease area due to the poor quality of the vegetation and heavy human influences. Antelope are now represented in the region by small numbers with low reproductive success and elk are represented by occasional, isolated sightings.

The mourning dove (Zenaidura macroura) is one of the more abundant game birds in the region. Small populations of scaled quail (Callipepla squamata) are encountered in brushy arroyos if there is sufficient food, water, and cover and an absence of human activities.

Many non-game species inhabit the region. These include rabbits, rodents, songbirds, raptors, reptiles, and amphibians. Larger forms such as coyotes and bobcats (Lynx rufus) may be found in the more remote areas. Scattered prairie dog (Cynomys gunnisoni) "towns," averaging an estimated 75 individuals, may be found in the region.

Many non-game species such as Spade-foot toads (Scaphiopus sp.) and true toads (Bufo sp.) are associated with ponds and reservoirs in the region, as well as the larval stages of several species of insects. There are no permanent streams in the proposed lease area that are capable of supporting fish populations.

### b. Threatened and Endangered Species

Only three of the ten threatened and endangered species of fish and wildlife in San Juan County have the potential for inhabiting the proposed lease area. (See Appendix C for data on threatened and endangered species in San Juan

County.) These are the black-footed ferret (Mustela nigripes), the bald eagle (Haliaeetus leucocephalus), and the peregrine falcon (Falco peregrinus anatum).

Although not recorded for San Juan County by Hubbard, et al. (1978), numerous sightings of the black-footed ferret have occurred in McKinley County to the south. One sighting, questionable in nature, was made near the McKinley-San Juan County line after 1960. The species also has been observed in the Ute Mountain Indian Reservation to the north in Colorado. The prairie dog is the principle food of the black-footed ferret. Since the range of the prairie dog extends to the proposed lease area, Hubbard (1979) states that the black-footed ferret may be encountered.

Six unverified sightings and one nest of the bald eagle have been listed for San Juan County. The sightings were either winter use or "fly-overs" and were all made after 1960. There is little suitable habitat for this species in the proposed lease area.

A single verified and four unverified sightings of the peregrine falcon were made in the San Juan County after 1960. Nesting sites characterized by high cliffs near permanent water sources are non-existent in the proposed lease area.

Field surveys and personnel of Federal and state conservation agencies indicate that the probability of either endangered or threatened species occurring in the proposed lease area as residents is, at best, remote.

### 9. Noise

Environmental noise level readings are not available for the proposed lease area. This is open, rural countryside, removed from noise-sensitive points where exposure to noise may be harmful or annoying. Higher noise levels would be expected outside the proposed lease area as a result of strip mining activities, electrical power generation, gas refining, and vehicular traffic. It is assumed that these noise levels would fluctuate, and tend to be generally higher during daylight than nighttime hours.

### 10. Visual Resources

In an analysis done by BLM for the Star Lake-Bisti Regional Coal Environmental Statement, the visual resources of the proposed lease area tentatively are identified as being in BLM Visual Resource Management (VRM) Class IV. VRM Class IV is one of five classes, with Class I having the highest management constraints. Each of these classes contain specific management objectives for maintaining or enhancing visual resource values, as described in BLM Manual 6310 (U.S. Dept. of Interior, Bureau of Land Management, 1975b). Management objectives of VRM Class IV allow for changes that may modify the original composition and character, but they must reflect what could be a natural occurrence within the characteristic landscape.

The VRM classification assigned to a given land area depends upon three factors: the inherent quality of the scenery; the visual sensitivity, which expresses the volume of viewers and attitudes toward changes in the scenery; and the distance zones from which the scenery is viewed.

The landscape features of the proposed lease area are evaluated as lacking outstanding quality. The two general landform features are gently sloping lands cut by small drainages, and small dissected mesas. Vegetation is predominantly low-growing grassland, with little variation in form, line, color, and pattern. Past and present uses of the proposed lease area and surrounding lands have resulted in numerous modifications to the natural landscape, including the introduction of structures.

The actual amount of use occurring on the proposed lease area is unknown, but is generally thought to be from off-road vehicle users and those people using a gas company road that crosses the area. Users are thought to have a low level of concern towards modifications to the visual resources. The area is screened by terrain and distance from state highways and population centers.

### 11. Recreation

The proposed lease area is located within the San Juan Planning Unit of the BLM Farmington Resource Area. The 2,815 acres available for public recreation use on the proposed lease area are approximately one-tenth of a percent of the land available for public recreation within the planning unit.

The proposed lease area has no developed recreation facilities and none are planned for the near future, but opportunities exist for dispersed types of recreation activities. The variety in terrain and soil types, the amount of open space, and the lack of hazards have made this area desirable for off-road vehicle use. The number of recreationists is unknown, but use is evident. The indications are that this is the primary type of recreation activity throughout the area in which the proposed lease is located.

Outside the proposed lease area, opportunities for a wide variety of recreation activities are available in the San Juan Planning Unit. These recreation opportunities are provided through businesses, local organizations, communities, county, State of New Mexico, Navajo Tribe, and Federal agencies.

## 12. Transportation

### a. Roads and Highways

There are several unimproved roads on the proposed lease area. These roads are unauthorized on public land. The road that lies on public land in T. 30 N., R. 15 W., NMPM, Sec. 24: $W^1/_2$ is the only unpaved road that has been observed to have been maintained.

County Road 61 provides access to the southeast corner of the lease area. This road also supplies access to the El Paso Natural Gas San Juan Plant, Basin Packing Company, several residential areas, a dump, and a stables area. There is no known average daily traffic count for this road.

N.M. 489 is located south of the San Juan River and connects the towns of Fruitland and Kirtland with U.S. Highway 550. The 1978 average daily traffic on the road at Kirtland was 4,705 vehicles.

U.S. Highway 550 is a Federal Aid Highway and one of the major highways in northwestern New Mexico. At the junction of County Road 61 and U.S. 550, the 1978 average daily traffic count was 10,374 vehicles.

### b. Rights-of-Way

There are eight current rights-of-way granted on the proposed lease area (see Map II-4 in Section 15, Land Status). Table II-3 lists the grantee, date of approval, and type of these rights-of-way. Letters to Western (Figures IV-1, IV-2 and IV-3) indicate that the parties involved in the rights-of-way are agreeable to leasing of the Federal coal.

Western has expressed a desire to file an application for an access road to the existing San Juan Generating Station. This road is expected to cross the proposed lease area. At this time, no application has been received by the BLM. An environmental assessment will be prepared upon submission of the applicant.

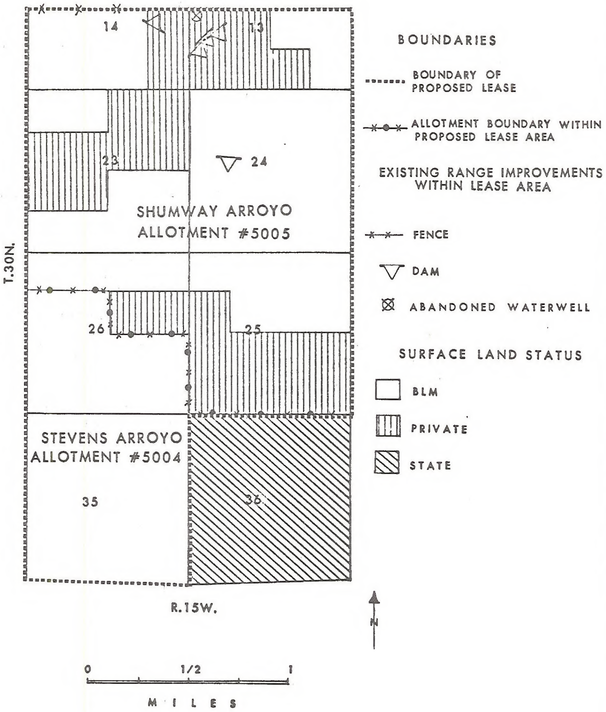
## 13. Grazing

As shown on Map II-3, the proposed lease area is located in the southern portion of the Shumway Arroyo Allotment (No. 5005) and the northern portion of the Stevens Arroyo Allotment (No. 5004). Each allotment has one operator. Cattle are run on both allotments.

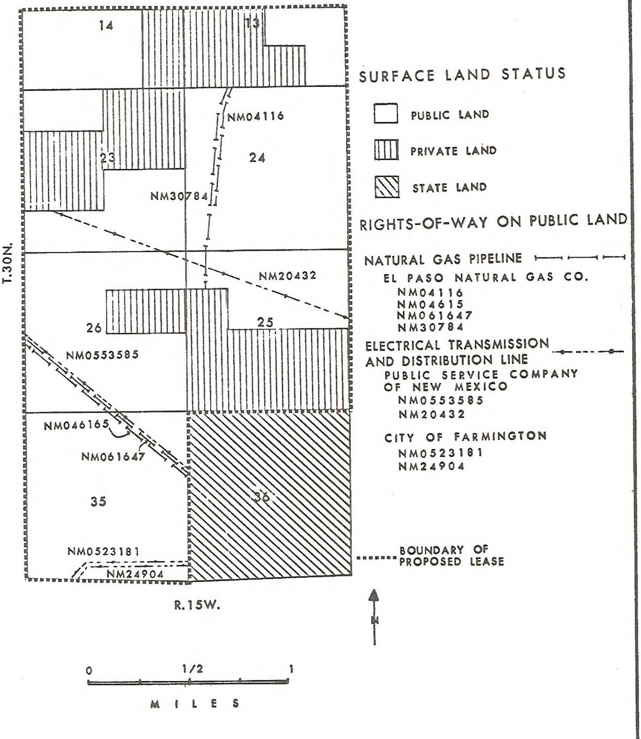
The Shumway Arroyo Allotment is presently under an Allotment Management Plan (*AMP*), with cattle grazing in the winter and early spring months (December 1 to April 30). Carrying capacity on the allotment averages 8.9 acres per Animal Unit Month (*Ac/AUM*).

## MAP II-3

## GRAZING ALLOTMENTS AND RANGE IMPROVEMENTS


14
13
23
24
SHUMWAY ARROYO ALLOTMENT #5005
26
25
STEVENS ARROYO ALLOTMENT #5004
35
36
T.30N.
R.15W.
BOUNDARIES
BOUNDARY OF PROPOSED LEASE
ALLOTMENT BOUNDARY WITHIN PROPOSED LEASE AREA
EXISTING RANGE IMPROVEMENTS WITHIN LEASE AREA
FENCE
DAM
ABANDONED WATERWELL
SURFACE LAND STATUS
BLM
PRIVATE
STATE
N
0
1/2
1
MILES

MAP II-4
LAND STATUS



# TABLE II- 3

## RIGHTS-OF-WAY ON THE PROPOSED LEASE AREA

| Approved Date | Serial Number | Grantee | Type of Right-of-Way |
|---|---|---|---|
| 7/16/1951 | NM-04116 | El Paso Natural Gas Company | Natural Gas Pipeline |
| 5/8/1958 | NM-046-165 | El Paso Natural Gas Company | Natural Gas Pipeline |
| 5/8/1959 | NM-061-647 | El Paso Natural Gas Company | Natural Gas Pipeline |
| 9/30/1964 | NM-0553-585 | Public Service Co. of New Mexico | Electrical Transmission Line |
| 8/18/1965 | NM-0523-181 | City of Farmington | Electrical Transmission Line |
| 2/11/1975 | NM-20432 | Public Service Co. of New Mexico | Electrical Transmission Line |
| 8/27/1976 | NM-24904 | City of Farmington | Electrical Distribution Line |
| 6/20/1977 | NM-30784 | El Paso Natural Gas Company | Natural Gas Pipeline |

The Steven's Arroyo Allotment is not on any AMP or formal grazing system. It is currently grazed by cattle from May 1 to November 30. Averge carrying capacity on the allotment is 9.7 Ac/AUM.

Range improvements on the proposed lease area include a 2 $^3/_4$-mile boundary fence separating the two allotments, and a $^1/_2$-mile pasture fence, 5 earth dams, and an inoperative waterwell on the Shumway Arroyo Allotment. (Refer to Map II-3 for range improvement locations.)

Range-related problems common to both allotments are: lack of dependable water, poor livestock distribution, lack of adequate livestock forage, vandalism, and unauthorized off-road vehicle use.

### 14. Wilderness

The BLM, in accordance with Section 603 of the Federal Land Policy and Management Act of 1976, is reviewing all public land roadless areas to determine their suitability or non-suitability for wilderness designation. The inventory process uses procedures outlined in the Wilderness Inventory Handbook (U.S. Dept. of Interior, Bureau of Land Management, 1978b). The initial inventory to determine which public lands in New Mexico possess wilderness characteristics for possible inclusion into the National Wilderness System was completed in March 1979, followed by a 90-day public comment and review period.

The proposed lease area is located in the San Juan Planning Unit. This planning unit, identified as Wilderness Inventory Unit NM-010-01, was evaluated as clearly and obviously having no potential for wilderness. The initial wilderness inventory contains a recommendation that this inventory unit does not qualify for intensive inventory and should be dropped from the wilderness review process. No designated wilderness areas, as defined by the Wilderness Act of 1964, exist in the vicinity of the proposed lease area.

### 15. Land Status

There is a total of 3,855 acres on CLA NM 28093. Of this 2,815 acres or 73 percent is public land under BLM administration (land status is shown on Map II-4). All the coal in the proposed lease area is Federal coal.

The BLM has granted six rights-of-way on the public land. These rights-of-way allow the grantee to construct, maintain, and use specific facilities for a predetermined period. The BLM has responsibility to prohibit land uses on and in the vicinity that would conflict with existing rights-of-way.

In addition to the rights-of-way, the BLM has issued oil and gas leases on the proposed lease area. Lessees are entitled to exploit the oil and gas resources on the lease tract. The BLM has responsibility to prohibit land uses on the oil and gas lease tracts that would hinder the orderly development of these resources.

Within the boundaries of the proposed lease area, 1,040 acres or 27 percent of the total are private lands. As of April 16, 1979, 20 owners of this private land were documented at the San Juan County Assessors Office.

### 16. Cultural Resources

The proposed lease area has not been intensively surveyed for archeological sites. The total number and significance of sites are therefore unknown. However, BLM site files and surveys for road and transmission line rights-of-way (Ford, 1979a; Enloe and Peckham, 1974) provide information on 14 sites known to exist within the area under study. Eleven of these sites are from the *Pueblo* (P) II and III periods (900-1300 A.D.). The remaining three sites are abandoned homesteads dating from post-1876 when the area was opened to Anglo settlers. Table II-4 summarizes information and estimates of significance of these sites.

No *Paleo-Indian* sites (8000-5000 B.C.) have been identified within the proposed lease area, but there is a small chance they are present as artifacts have been found south of Farmington in Gallegos Canyon (Hadlock, 1962). *Archaic* sites (5000-1000 B.C.) have not yet been found, but they probably will be discovered in the semi-stabilized dunes (Ford, 1979b). *Basket Maker* III (400-700 A.D.) and Pueblo I (700-900 A.D.) sites have not been found, but are reported from comparable areas nearby (Museum of New Mexico, 1971; Biella, 1975; and Ford, 1978a), and may be discovered upon survey of the proposed lease area. Navajo sites (1500 A.D.-recent), although not reported, are expected to occur, for they too are common in nearby areas of similar topography and flora (Museum of New Mexico, 1971; Biella, 1975; Ford, 1978a and 1979b). Table II-5 summarizes predictions of the number and type of sites that may be discovered by intensive archeological survey of the proposed lease area.

Significance cannot be estimated for predicted sites, but the proposed lease area may be useful in answering research questions concerning the San Juan area's relationship with the intricate *Chacoan Complex* to the south and the Mesa Verde culture to the north. Prehistorically, the environment of the Shumway drainage may have been similar to that of the La Plata (Ford, 1978b), which today cradles many archeological sites with valuable data.

There are no known Navajo sacred places on the proposed lease area. Likewise, the location contains no sites presently on the National or State Registers of Historic Places. The nearest such site is "Pictured Cliffs" (T. 29 N., R. 15 W., Sec. 5), a petroglyph panel listed on the State Register. Known

## TABLE II-4

## KNOWN ARCHEOLOGICAL SITES ON THE PROPOSED LEASE AREA

| Site No. | Section No. | Culture/Dates | Description | Significance 1/ | Surface Ownership |
|---|---|---|---|---|---|
| 1015 | 36 | PIII (1075-1200 A.D.) | House mound, artifacts | 4 | Federal (BLM) |
| 1034 | 13 | PII-III (1050-1300 A.D.) | House mound, artifacts, medium erosion | 3 | Private |
| 3425 | 14 | PII-III (1050-1300 A.D.) | Sherd scatter, good condition | 3 | Federal (BLM) |
| 3426 | 14 | PII-III (1050-1300 A.D.) | Sherd scatter, good condition | 3 | Federal (BLM) |
| 3427 | 24 | PII-III (1050-1300 A.D.) | 2-3 rooms, artifacts, poor condition, erosion and vandalism | 3 | Federal (BLM) |
| 3428 | 24 | PII-III (1050-1300 A.D.) | Sherd scatter, poor condition, roadcut and erosion | 2 | Federal (BLM) |
| 3429 | 26 | PII-III (1050-1300 A.D.) | Hearths, artifacts, good condition | 4 | Federal (BLM) |
| 3430 | 13 | Anglo (ca. 1909 A.D.) | DeBeau homestead, poor condition. | 2 | Private |
| 3431 | 13 | PII (1050-1150 A.D) | House mound, dense artifact scatter, good condition | 5 | Private |
| 3432 | 13 | Anglo (ca. 1909 A.D.) | Hutchins homestead, poor condition | 2 | Private |
| 3433 | 13 | PII (1050-1150 A.D.) | House mound, artifacts, medium erosion | 5 | Private |
| 3434 | 23 | PII (1050-1150 A.D.) | Sherd scatter, good condition | 3 | Private |
| 3435 | 23 | Anglo (post 1910 A.D.) | Homestead, poor condition, erosion and collection | 2 | Private |
| SJC 409 | 36 | PIII (1000-1250 A.D.) | Rubble mound, 2-3 rooms?, dense artifact scatter | 4 | State |

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1/ A greater number indicates higher significance. See Appendix D for a complete explanation of the 6-point scale for estimating significance.

## TABLE II-5

## PREDICTED NUMBER AND TYPE OF ARCHEOLOGICAL SITES 1/

| Site Type | Density (Sites/Square Mile) | Total on Proposed Lease Area |
|---|---|---|
| Paleo-Indian | ? | ? |
| Archaic | .6 | 4 |
| Anasazi | 6.9 | 48 |
| Navajo | 1.6 | 11 |
| Other (Anglo, indeterminate) | .9 | 6 |
| Total | 10.0 | 69 |

---

1/ Eastimates, which are based on the work of Biella (1975) and Ford (1978a) in nearby areas with similar topography and flora, tend to be generous.

sites within the study area have not been subjected to consultation with the State Historic Preservation Office to determine their eligibility for the registers. SJC 409, near the access road right-of-way, has been granted a BLM clearance with the stipulation that the site be fenced to protect it from construction activities and off-road travel.

### 17. Socioeconomic Conditions

San Juan County is the basic area discussed in this section, since most of the socioeconomic changes resulting from development on the proposed lease area would take place within its bounds. The county is experiencing a period of economic growth and social change that is stimulated by minerals-related industry. This includes principally the recovery of coal, gas and oil, and the production of electricity.

#### a. Demographic Features

The estimated 1979 population of San Juan County is 76,800, a 46 percent increase over the 1970 population. The overall population density of the county remains a relatively low 13.8 persons per square mile. In 1977 an estimated 61 percent of the county population lived in urban areas (Harbridge House, 1978). The population engaged in energy-related employment is concentrated in the northeastern quarter of the county (San Juan County Planning Dept., 1978).

San Juan County possesses three major incorporated communities: Farmington, Aztec, and Bloomfield. The estimated 1977 populations of these communities were 29,750, 4,650, and 2,200, respectively (Harbridge House, 1978). Farmington is the largest city in northwestern New Mexico. The unincorporated community of Shiprock, located 30 miles west of Farmington on the Navajo Reservation, was estimated to have a 1977 population of 5,500 (Harbridge House, 1978).

#### b. Economic Characteristics

Economic activity sectors producing the most income in San Juan County in 1977 were: (1) construction, (2) government, (3) mining, (4) transportation, communications, and utilities, and (5) trade. The growth of tourism has added to the importance of the trade and services sectors (Harbridge House, 1978).

An estimated 27,411 persons in San Juan County were employed full-time in 1977, reflecting a two-year increase of about 25 percent. The three economic sectors that supplied the most jobs were services, trade, and construction. Mineral extraction provided jobs for a reported 9.3 percent of employed persons (Harbridge House, 1978). (Reported employment and income for these and other employment categories are shown in Table II-6.) Much of the growth in the services, trade and construction sectors has stemmed from mining and related

## TABLE II-6

### EMPLOYMENT AND PERSONAL INCOME IN SAN JUAN COUNTY
(employment as of 1977; income, in thousands of dollars, as of 1975)

| Sector | Workers | % of Workers | Income | % of Income |
|---|---|---|---|---|
| Agriculture | 569 | 2.1 | $ 2,950 | 1.3 |
| Mining | 2,557 | 9.3 | 37,738 | 16.8 |
| Metal | 0 | 0 | 0 | 0 |
| Petroleum | 1,920 | 7.0 | — | — |
| Coal | 637 | 2.3 | — | — |
| Construction | 4,704 | 17.2 | 40,428 | 18.0 |
| Manufacturing | 1,114 | 4.1 | 9,655 | 4.3 |
| Transportation, Communications & Utilities | 2,821 | 10.3 | 35,410 | 15.8 |
| Trade | 5,270 | 19.2 | 34,094 | 15.2 |
| Finance, Insurance & Real Estate | 713 | 2.6 | 5,861 | 2.6 |
| Services & Miscellaneous | 5,553 | 20.3 | 20,217 | 9.0 |
| Government | 4,110 | 15.0 | 38,273 | 17.0 |
| TOTAL | 27,411 | 100% | 224,626 | 100% |

Source: Harbridge House, 1978

activities. Employment in the transportation, communications, and utilities sector is relatively high due to the Four Corners and the San Juan Power Plants.

Western has indicated that 392 employees will be needed for the underground mining operation on their existing lease. Assuming that other energy-related employment remains constant, combined employment from the surface mine and underground mine operations on Western's existing lease will account for approximately seven percent of the direct energy-related employment in the county by mid-1980. This will exert a moderate influence on the economy of the region.

### c. Social and Cultural Characteristics

Three cultures exist within San Juan County: Indian (Navajo and Ute), Hispano (Spanish-American), and Anglo (non-Spanish whites). The three cultures have maintained a measure of independence, with separate languages, value systems, and religious traditions.

Life styles range from the subsistence grazing of rural Navajo to urbanized patterns. As grazing becomes less profitable, rural residents are forced to migrate into urban areas to obtain work. County unemployment rates are particularly high for cultural minorities. The 1977 unemployment rate was 14.7 percent for Indians, 10.5 percent for Hispanos, and 7.5 percent for all workers (Harbridge House, 1978).

The predominance of Anglos in the Farmington-Aztec-Bloomfield area has intensified pressures on Indians and Hispanos to conform to the dominant values and lifestyles. Recent minerals development has resulted in the in-migration of Anglos from outside northwestern New Mexico. These trends have brought the three cultures into greater conflict and relations are often strained.

### d. Community Infrastructure

#### 1) Government and Major Administrative Groups

Several levels of government operate within San Juan County, and the jurisdiction of Federal, state, county, regional, municipal, special district, and tribal agencies often overlap. The number of governments is usually higher in the urbanized areas, but the checkerboard pattern of land ownership results in a confusion of jurisdictions even in rural areas.

#### 2) Housing

There has been a persistent scarcity of adequate housing. Reportedly, builders have been avoiding speculative construction due to the consequences of an earlier boom-bust experience. The lack of sufficient capital for financing, the shortage of available land, the lack of water and sewer services in many areas, and costs associated with bringing in building materials from distant suppliers also have been cited as having a limiting effect on housing construction. Mobile homes make up a large share of new residential units.

### 3) Educational Systems

San Juan County is divided into four public school districts. Education also is provided by Bureau of Indian Affairs schools serving Indians, and a number of private schools sponsored principally by religious groups and enrolling mostly Indians. The San Juan campus of New Mexico State University is located in Farmington, and a branch of Navajo Community College in Shiprock. Both these schools offer Associate of Arts degrees.

### 4) Welfare

A total of 10,741 persons, representing about 14 percent of the population within San Juan County, received public assistance, food stamps, or both in April of 1979. A total of 7,543 persons, representing slightly over 11 percent of the county population, were recipients of similar aid in the same month of 1978.

### 5) Health Care

Public health programs are conducted by the Indian Health Service, non-profit corporations, and the county health agency. In 1977, the population was served by 58 physicians, 36 registered nurses, 50 licensed nurses and 23 dentists, numbers significantly lower than the national average (Harbridge House, 1978). Several clinics and two hospitals are located in the county. San Juan Hospital at Farmington has 187 available beds, and Shiprock Indian Hospital at Shiprock has 69 available beds.

### 6) Police Protection

Reported crimes increased 11.2 percent from 1971 to 1976. In the Governor's Council of Criminal Justice 1977 Comprehensive Plan, San Juan County was designated a Class II High Crime Area. There were 46.4 reported crimes per thousand residents in 1976, a higher ratio than in any of the other five northwestern New Mexico counties. The 146.5 police officers serving the county in 1977 provided a ratio of one officer per 524 residents, about equal to the minimum recommended by the Federal Bureau of Investigation. The vast area, rugged terrain, dispersed populations, and checkerboard pattern of land ownership complicate police protection. State, county, and tribal jurisdictions overlap, occasionally resulting in confusion of jurisdiction.

#### 7) Water Supply Systems and Wastewater Systems

Available surface water is scarce even along the San Juan and Animas Rivers. Ground water often has large quantities of minerals and salts, and withdrawals must be processed. The incorporated cities and several of the small unincorporated villages have community water systems. Families living in remote areas may have springs or wells but most rural inhabitants of the Navajo Reservation must haul water.

The community of Shiprock and the Cities of Aztec, Bloomfield, and Farmington have sewage systems with sufficient reserve capacity to accommodate future growth. Sewage from individual residential systems usually is delivered to septic tanks.

## C. Unsuitability Criteria

On June 1, 1979, final criteria to determine lands unsuitable for coal mining were selected by the Department of the Interior. Unsuitability criteria relevant to the proposed lease area are discussed in the following paragraphs.

### 1. Rights-of-Way and Easements

BLM has granted 6 rights-of-way on the proposed lease area. All parties involved in the rights-of-way have agreed in writing to coal leasing (see Figures IV-1, IV-2, and IV-3).

### 2. Historic Lands and Sites

No lands and sites on the proposed lease area presently are included in the National Register of Historic Places, but ten known sites may be eligible. An intensive archeological survey of the area may discover others. After cultural resources are known, the State Historic Preservation Officer will be consulted for an official determination of sites eligible for nomination. (See Chapter III, Cultural Resources.)

### 3. Federally Listed Endangered Species

There is no legally designated critical habitat for Federal threatened and endangered plant or animal species on the proposed lease area, nor habitat of essential value where the presence of threatened and endangered species has been scientifically documented. While a potential exists for the occurrence of the black-footed ferret, bald eagle, and peregrine falcon, field surveys and personnel of Federal and state conservation agencies indicate that the probability of resident threatened and endangered species on the proposed lease area is remote. Therefore, it has been determined that formal Section 7 consultation with the U.S. Fish and Wildlife Service will not be held.

### 4. State-Listed Endangered Species

No habitat on the proposed lease area is deemed critical or essential for plant or animal species listed on New Mexico State Game Commission Regulation No. 563, Endangered Species and Subspecies of New Mexico. The black-footed ferret, bald eagle, and peregrine falcon are listed as endangered by the State of New Mexico, but the probability of encountering these species on the proposed lease area is minimal.

### 5. Floodplains

Hutch Canyon and Shumway Arroyo floodplains are shown on maps provided by the Federal Insurance Administration, but these channels have small drainage areas and show no evidence of floodplain development. The channels are entrenched, and eroding rather than depositing material. Plans for the diversion of flow from Shumway Arroyo around the San Juan Surface Mine would eliminate potential flood damage. Underground mining should have no other effect on surface flows.

### 6. Unapplicable Criteria

a. Federal Land Systems

b. Buffer Zones Along Rights-of-Way and Adjacent to Communities and Buildings

c. Wilderness Study Areas

d. Scenic Areas

e. Lands Used for Scientific Studies

f. Natural Areas

g. Bald and Golden Eagle Nests

h. Bald Eagle Roost and Concentration Areas

i. Falcon Cliff Nesting Sites

j. Migratory Birds

k. State Resident Fish and Wildlife

l. Municipal Watersheds

m. National Resource Waters

n. Alluvial Valley Floors, as defined under the Surface Mining Control and Reclamation Act of 1977

o. State Proposed Criteria

# CHAPTER III

# ENVIRONMENTAL CONSEQUENCES

# CHAPTER III

## ENVIRONMENTAL CONSEQUENCES

This chapter addresses the environmental consequences of the proposed action and other alternatives set out in Chapter I. Discussion includes the environmental impacts that would result from these alternatives; any recommended measures for mitigating impacts beyond measures required by law; and the unavoidable adverse impacts that would remain after mitigation. The relationship between short-term use of resources during coal mining and long-term productivity of resources is addressed; as well as the irreversible commitments of resources that would continue once initiated, and the irretrievable commitments that would result from resources being used up, lost, or destroyed.

Information is presented to show the environmental consequences of the alternatives for each resource. In many cases, a single consequence would be shared by several resources. The following groupings of resources have been made to aid clarity and avoid repetition.

- If the no-action alternative was implemented, there would be no impacts on geologic setting, soils, water resources, vegetation, recreation, grazing, and land status.
- For all resources the impacts of the delay-the-action alternative during the period of delay would be the same as those described for the no-action alternative. After lease issuance, the impacts would be the same as for the proposed action or other-owner alternative, depending on whether Western or another owner became the lessee.
- No mitigation measures are recommended for air quality, geologic setting, soils, water resources, vegetation, noise, recreation, grazing, wilderness, and socioeconomics beyond those required by law (see Table I-3).
- All identified impacts would be unavoidable and adverse for air quality, geologic setting, paleontology, soils, vegetation, wildlife, noise, visual resources, recreation, transportation, grazing, wilderness and land status.

- The short-term use of the resource resulting from the mining of coal would not affect the long-term productivity of air quality, soils, water resources, vegetation, noise, visual resources, recreation, transportation, grazing, wilderness, and land status.
- There would be no irreversible or irretrievable commitments of resources for water resources, noise, visual resources, recreation, transportation, wilderness, and land status.

## A. Air Quality

### 1. Impacts

#### a. Proposed Action

Particulate emissions would be the main pollutant resulting from the mining of coal from the proposed lease area. Western estimates that 42.8 tons of particulates per year would be emitted into the air as a result of their underground mining operation. If Western acquires a lease for the coal on the proposed lease area, these emissions would continue for an estimated 22 to 26 years longer than if they did not acquire a lease. This is a relatively small quantity in comparison to the predicted 1,067 tons of particulate emissions in 1980 from the adjacent San Juan Surface Mine (Radian, 1978). The particulate emissions would be from conveyors, coal transfer points, wind erosion of storage piles, and traffic-generated dust.

There are no designated areas of non-attainment for total suspended particulates or Class I air quality areas close enough to the proposed lease area to be impacted by emissions from mining of coal in the proposed lease area.

#### b. No-Action Alternative

Particulate emissions from coal brought in from other locations for use at the San Juan Generating Station would be similar in magnitude to emissions from handling coal from the proposed lease area. These emissions would result from dumping loads into a dump hopper, conveying coal into a stockpile, wind erosion from the stockpile, and conveying coal from the stockpile to the generating station facilities.

Gaseous pollutants would be emitted from trucks used to haul the coal. These emissions of carbon monoxide, hydrocarbons, nitrogen oxides, sulfur oxides, and particulates would occur along the route of travel. The total quantities of these emissions and the impacts on existing environments along the route cannot be determined without knowing the length of haul and the route to be taken.

#### c. Other-Owner Alternative

An estimated 45 tons of particulates would be emitted into the air each year because of activities relating to the mining and processing of coal from the proposed lease area. This would be a new source of emissions in the area, and would be the only significant emissions resulting from this alternative if the coal produced was marketed locally for use at the San Juan Generating Station.

However, if the coal mined was marketed elsewhere there would be additional emissions of carbon monoxide, hydrocarbons, nitrogen oxides, sulfur oxides, and particulates from the trucks used to haul the coal to the railroad near Gallup, New Mexico. These emissions would be from trucks traveling a cumulative total of 71,680 miles per day, five days per week. Additional emissions would occur from hauling coal to the San Juan Generating Station as described for the no-action alternative.

### 2. Irreversible and Irretrievable Commitments of Resources

For all alternatives, the loss of cleaner air from emissions would be irretrievable.

## B. Geologic Setting

### 1. Impacts

#### a. Proposed Action

If coal was mined by the longwall method, subsidence of 6 to 10 feet could be expected. However, a determination on use of the longwall method would not be made until after mining had begun. Operations would begin with the room-and-pillar method and convert to longwall if approval was granted by OSM. Subsidence would occur over a maximum of 4,504 acres. If the operations remained room-and-pillar for the life of the mine, there would be little future subsidence.

Subsidence would cause some topographic change. Potential deformation from subsidence could include: tension cracks above barrier pillars a few months after mining ceased; compression bulges on the surface about 1 $^1/_2$ to 2 years after completion of mining; and tension cracks as the surface subsided to its final level several years after mining ceased. Rock falls would be unlikely, due to the relatively gentle topography.

Leveling, cutting, and filling of exploration drill sites, access roads and ventilator shafts would cause minor topographic changes. An exploration plan would have to be submitted by a prospective lessee to better assess the environmental impacts related to exploration activities.

About 50-55 percent of the coal would be left underground in seams mined by the room-and-pillar method. This figure is fairly typical for this type of mining. If a conversion to longwall mining occurred, approximately 35 percent of the coal would be left underground.

A relatively low oil and gas potential exists in the proposed lease area, although about 75 percent of the area is covered by oil and gas leases. Simultaneous oil and gas exploration and development can be considered non-compatible with coal mining operations. Drilling for oil and gas through mined areas is difficult because drilling fluids are lost in mined-out areas until drill-holes are cased.

The proposed lease area has a slight potential for uranium deep-mining, because the uranium-bearing Morrison Formation lies approximately 3,000-5,000 feet beneath the surface. No uranium or other types of mining claims currently exist on these lands.

#### b. Other-Owner Alternative

Impacts from this alternative would be the same as from the proposed action, except that 3,855 acres would be impacted (a decrease of 649 acres).

### 2. Short-Term Use and Long-Term Productivity

#### a. Proposed Action

Under the short-term use, 50-70 million tons of coal would be mined and unavailable for future production. These figures refer to the lower seam. Another 21-28 million tons could be mined from the upper seam and would, therefore, be unavailable for future production. Improvements in mining technology, resulting in higher recovery rates, are likely to occur in the future. Therefore, the extraction of coal in the short-term means that less coal would be recovered than if mining was deferred to a future time.

Coal development would make future exploration and long-term production of oil, gas, and uranium more difficult. Oil companies, for example, do not normally drill for at least 40 years after the cessation of underground coal mining. Therefore, the use and commitment of the coal resource involves a trade-off between presently needed coal and the slight but possible future development of other energy resources.

#### b. No-Action Alternative

If this alternative was adopted, no coal would be mined in the near future. If mining occurred at some later date, a higher percentage of the coal would be recovered. Not mining the coal would make exploration and possible development of oil, gas, and uranium more feasible.

#### c. Other-Owner Alternative

The same short-term/long-term relationship as described for the proposed action would exist for mining the coal from the proposed lease area. Additionally, the acquisition of the lease by a party other than Western would make the recovery of coal from Western's state lease in section 36 unlikely. It would not be economically profitable for Western to mine on this section without holding a lease for the adjacent area. Approximately 24 million tons of coal, in two seams, are estimated to underlie this section.

### 3. Irreversible and Irretrievable Commitments of Resources

#### a. Proposed Action

The commitment of 50 to 70 million tons of coal from the lower seam to mining would be irretrievable. After this coal was removed, the remaining 35 to 55 million tons of coal in the lower seam would be inaccessible. If the upper seam was mined, 21 to 28 million tons of coal would be irretrievably committed. After this coal was removed, the remaining 14 to 21 million tons in the upper seam would be inaccessible.

Mining would irreversibly and irretrievably commit 4,504 acres to possible subsidence. Subsidence could be expressed as surface deformation, depressions, bulges, or tension cracks. If subsidence occurred without the upper seam being mined, a potential 21-28 million tons of recoverable coal would be lost.

#### b. Other-Owner Alternative

The irreversible and irretrievable commitments from this alternative would be the same as from the proposed action, except that 3,855 acres would be impacted (a decrease of 649 acres).

## C. Paleontology

### 1. Impacts

#### a. Proposed Action

Impacts on the paleontological resources would be negligible during development and eventual operation of an underground coal mine in the proposed lease area. However, because of increased human accessibility to the exposed fossil-bearing rocks in the eastern portion of the lease, a corresponding increase in unauthorized collection of fossil vertebrates would occur. It is possible that the remains of large vertebrates occurring in the coal bed would be destroyed by mining.

### b. No-Action Alternative

For collecting sites in the Kirtland Formation, impacts resulting from the natural weathering of fossils would continue at the present rate. Unauthorized collection of fossil vertebrates from the Kirtland Formation would probably increase, as a direct result of the current population growth in the Farmington area and the resurgence of interest in fossil collecting by amateurs. Fruitland rock units, because they are beneath the surface, would remain in their present physical state.

### c. Other-Owner Alternative

Impacts on paleontological resources in the proposed lease area could be of the same type and magnitude as those anticipated from the proposed action. However, other ownership might result in the construction of mine shafts and ancillary facilities that would, depending upon their location, have a profound influence on an undetermined number of collecting sites at exposures of the Kirtland Formation.

## 2. Recommended Mitigation

During mine development and later operation, all employees, contractors, subcontractors, and their employees must be advised that removal of fossils from the area is prohibited. In the event that fossils are discovered, the BLM or its designated authority is to be notified so that the BLM can take appropriate action under Washington Office Instruction Memorandum 79-111, p. 2, Procedure 10.

## 3. Short-Term Use and Long-Term Productivity

### a. Proposed Action

An unknown number of fossil-collecting sites in the Fruitland Formation could be destroyed during mining. If such sites were discovered, some fossil material could be retained for future research. Unauthorized collecting or vandalism in exposed rocks in the vicinity of the mine would further hinder long-term productivity of fossil localities.

### b. Other-Owner Alternative

This alternative ultimately would produce the same relationship between short-term use and long-term productivity that has been defined for the proposed action.

## 4. Irreversible and Irretrievable Commitments of Resources

### a. Proposed Action

An indeterminable number of unknown fossil localities would be unstudied or partially studied and eventually destroyed. If fossils from such localities were unique and were not recovered, their loss would be irretrievable.

#### b. No-Action Alternative

Fossils lost from weathering and unauthorized collecting would be irretrievable.

#### c. Other-Owner Alternative

The irretrievable loss would be the same as from the proposed action.

## D. Soils

### 1. Impacts

#### a. Proposed Action

Due to construction of access roads and seven ventilation facilities, about 14 acres of soil eventually would be disturbed. Productivity would be lost until about the year 2015.

The number of exploratory drill sites and locations has not been determined. Access to most sites could be gained by existing roads or by traveling cross-country. Some new roads might be necessary for potential drill sites in rough terrain. If additional roads were needed, the erosion potential would be great. An estimated 16 surface acres would be disturbed by exploration. Impacts from possible future subsidence cannot be predicted.

#### b. Other-Owner Alternative

An additional 19 acres of soil would be disturbed. Impacts also would result from construction of powerlines and new access roads. Acres of soil disturbed as a result of those facilities are undeterminable. Reclamation would be more difficult, since much more topsoil would have to be hauled into the disturbed areas.

### 2. Irreversible and Irretrievable Commitments of Resources

The loss of the soils productivity resulting from the previously identified impacts would be irretrievable.

## E. Water Resources

### 1. Impacts

#### a. Proposed Action

Ground water inflow to an underground mine in the proposed lease area is estimated to be very low, approximately 115 acre-feet per year (Western, 1979c). The quality of the mine water inflow would be similar to existing water quality in the coal formation (Table II-2). Water quality would be suitable for dust suppression, marginal for livestock watering, and unsuitable for irrigation purposes. Mining plans call for the use of 60 acre-feet per year for underground dust suppression, with up to 90 additional acre-feet per year being used for surface dust suppression (Western, 1979c). If mine water inflow should exceed 150 acre-feet, the excess mine water could be discharged, probably to Shumway Arroyo.

Except for increased sediment movement from disturbed areas, surface runoff and water quality would be unaffected by an underground mine. Sediment yields would increase from approximately 30 surface acres disturbed by construction of ventilation facilities and access and service roadways. Estimated sediment movement from these areas would be approximately 30 tons per year until these areas were revegetated. Sediment yields could increase substantially if mine pillars were removed and subsidence occurred. Such subsidence would initiate gully development and lead to increased channel erosion. The magnitude of this impact cannot be predicted. Subsidence resulting from removal of pillars could also destroy McCabe's Dam.

#### b. Other-Owner Alternative

Ground water inflow would be slightly less than from the proposed action, due to the smaller mine size. Sediment yields from disturbed areas would be increased, by additional construction needed to develop the coal. Total sediment yield from disturbed areas is estimated at 50 tons per year until the disturbed areas were reclaimed. Impacts resulting from subsidence would be similar to those resulting from the proposed action.

### 2. Unavoidable Adverse Impacts

#### a. Proposed Action

Small increases in sediment movement from disturbed areas would occur as a result of construction activities. Total discharge would be very small (less than 30 tons per year from approximately 30 acres). If pillars were removed, sediment yield of undetermined magnitude could occur from subsidence-induced gully development and channel erosion.

#### b. Other-Owner Alternative

Unavoidable impacts would be the same as from the proposed action. Sediment movement would be approximately 50 tons per year from 49 acres disturbed by construction activities.

## F. Vegetation

### 1. Impacts

#### a. Proposed Action

About 14 acres of grassland vegetation would be destroyed by construction of ventilation shafts and service roads. Vegetation destruction of approximately 16 acres could result from exploratory drilling, assuming 100-foot spacing of drill holes and destruction of vegetation on an area 50 feet in diameter at each drill site.

#### b. Other-Owner Alternative

Grassland vegetation would be destroyed on about 49 acres if the proposed lease area was mined under this alternative. This destruction would result from developing 6 ventilation shafts, service roads, a portal, and coal processing and mine-support facilities.

### 2. Irreversible and Irretrievable Commitments of Resources

For all alternatives the vegetative productivity lost due to the destruction of vegetation described as impacts would be irretrievable.

## G. Wildlife

### 1. Impacts

#### a. Proposed Action

Exploratory activities would have a slight impact on native fauna. Construction of access and service roads and ventilation shafts would have extensive impacts on native wildlife populations. Cumulative impacts from various mining activities and related developments would alter wildlife diversity, density, and habitat utilization in the area. The magnitude of impacts from mining operations would be quite variable, but considerably less than during the construction stage.

Destruction of 30 acres of the grassland habitat would reduce escape cover, dens, nesting sites, and food availability for numerous species of mammals (especially rodents), birds, reptiles, amphibians, and arthropods. In addition, inter- and intra-specific competition would result in habitat displacement of various wildlife species on adjacent lands.

Some mammals (mainly rodents), reptiles, amphibians, and numerous invertebrates would be destroyed by direct impacts associated with mining activities. These impacts would be localized and limited. Secondary consumers (carnivorous predators) would be affected by a loss of prey species (herbivores). Displaced predators would tend to migrate into other habitats that were already at a limit for sustaining wildlife populations.

Abandonment of mining could have a beneficial effect on wildlife resources. The development of new vegetative communities would draw wildlife, although the faunal composition after reclamation would not be the same either qualitatively or quantitatively.

While the potential exists, it is unlikely that black-footed ferrets will be found in the proposed lease area. Increased human activity could inhibit any habitat and feeding utilization and result in illegal shooting of peregrine falcons and bald eagles.

### b. No-Action Alternative

Additional traffic from trucking coal to the San Juan Generating Station would increase the probability of wildlife mortality, especially among smaller, less mobile species. Higher traffic noise levels would disturb many larger species of wildlife, preventing use of adjacent habitats for breeding, feeding and other life activities.

### c. Other-Owner Alternative

The basic impacts on wildlife resources would be similar to the proposed action. However, since duplicate facilities would be required for a second owner, an additional 19 acres would be impacted. The attendant noise and vehicular traffic would prevent habitat utilization by larger species of vertebrates. Many small species would undergo habitat loss or be killed by vehicles during construction and mining.

## 2. Recommended Mitigation

There is a remote possibility that the lease area may serve as habitat for other endangered species besides the black-footed ferret. It is recommended that the applicant, through contract and in consultation with the U.S. Fish and Wildlife Service, the BLM, and the New Mexico Department of Game and Fish, perform monthly checks on a diel (dusk to dusk) basis to determine the presence or absence of those species listed in Appendix C or any subsequent list of threatened and endangered species prepared by Federal or state conservationist agencies.

If such a species is located, the applicant must contact the above agencies for possible mitigation measures.

### 3. Short-Term Use and Long-Term Productivity

#### a. Proposed Action

Mining operations and associated activities would limit the area that could be used by certain species of wildlife for the life of the project, and possibly longer. The land may not be entirely rehabilitated after abandonment. Wildlife formerly in the area may not return. Should endangered species be encountered and adversely affected during the life of the project, their long-term productivity could be greatly impaired.

#### b. No-Action Alternative

The short-term use shown as impacts for this alternative would not affect the long-term productivity of wildlife.

#### c. Other-Owner Alternative

The relationship between short-term use and long-term productivity as defined for the proposed action would be altered qualitatively and quantitatively by the additional acreage and equipment.

### 4. Irreversible and Irretrievable Commitments of Resources

#### a. Proposed Action

Any loss of endangered species would be an irreversible and irretrievable commitment. Any wildlife production prevented by the proposed action would be irretrievably lost.

#### b. No-Action Alternative

There would be no irreversible and irretrievable commitments of wildlife resources.

#### c. Other-Owner Alternative

Irreversible and irretrievable commitments of wildlife resources would be the same as the proposed action.

## H. Noise

### 1. Impacts

#### a. Proposed Action

Noise levels are not expected to be harmful to the public, but could be disruptive to wildlife. The primary source of noise during exploration would be from equipment used for drilling and development of access to drill sites. Exploration activities have been projected to last 90 to 120 days. Location and duration of drilling would keep changing within the proposed lease area. In the next stage of development, the primary source of noise would be from construction of vent shafts, vent system facilities, and access roads. The primary noise during mining would be generated by ventilation fans. These fans would create a constant noise audible for the life of the mine, except during possible periods of shutdown.

#### b. No-Action Alternative

Increased noise levels along U.S. Highway 550 and 666, State Highway 17, and County Road 61 would result from the hauling of 160 or more truckloads of coal per day to the San Juan Generating Station.

#### c. Other-Owner Alternative

Impacts would be the same as the proposed action if the coal was used at the San Juan Generating Station. Without this source of coal, trucking additional coal in for the generating station would increase noise levels along U.S. 550, U.S. 666, and N.M. 17.

## I. Visual Resources

### 1. Impacts

#### a. Proposed Action

Modifications to vegetation and landform features and the introduction of vent shafts, would create moderate to weak contrasts with elements of form, line, color, and texture in the characteristic landscape. Removal of vegetation would break the existing texture and produce new lines. Minimal landform alteration would result from grading and leveling on approximately 30 acres for exploration activities, roads, and vent shafts. Landform alterations also would result from subsidence. These modifications to the landscape would meet VRM Class IV objectives. They would attract attention, but would not dominate the landscape. Due to existing mining activities on adjacent leases to the west, these modifications would appear to be extensions of those already occurring in the area.

#### b. No-Action Alternative

Although visual resources within the proposed lease area would remain essentially unchanged, mining activities on adjacent existing leases, roads, and other developments could have some negative influence on scenic values as viewed by people using the proposed lease area.

#### c. Other-Owner Alternative

Impacts would be the same as the proposed action.

### 2. Recommended Mitigation

To meet Visual Resource Management Class IV requirements, surface structures must be painted to blend with the dominate color of the landscape in the immediate area, except where specific colors are recommended to meet safety requirements.

## J. Recreation

### 1. Impacts

#### a. Proposed Action

Approximately six acres would be removed from recreation use for ventilation shafts. Another 24 acres would be converted from open land to access and service roads. A maximum of 4,504 acres could be affected by subsidence.

#### b. Other-Owner Alternative

Impacts would be the same as the proposed action.

## K. Transportation

### 1. Impacts

#### a. Proposed Action

Because Western will open an underground mine regardless of issuance of CLA 28093, existing traffic will continue. Should Western obtain the lease, the traffic would be continued for a longer period on County Road 61, N.M. 489, and U.S. 550. Estimated fatality rates for all types of vehicles on all types of roads would be 13.66 per 100 million miles driven (New Mexico Highway Dept., 1979).

If the longwall method of mining was used, 6 to 10 feet of surface subsidence could occur on the proposed lease area. Subsidence of this magnitude would make the surface of the proposed lease area unsuitable for road and current rights-of-way uses.

b. No-Action Alternative

This alternative would result in 160 or more individual truckloads of coal per day being delivered to the San Juan Generating Station. Each truck would travel a minimum of 200 miles per trip over rugged terrain. An estimated minimum of 1.6 additional fatalities per year would occur if this alternative was adopted. The impacted highways would be U.S. 550, U.S. 666, N.M. 17, and County Road 61.

c. Other-Owner Alternative

The following trucking needs for this alternative are based on the removal and delivery of 2 million tons of coal annually to the railroad at Gallup, New Mexico. The number of round trips per day would vary proportionately with the tons of coal produced.

| | Round trips/day |
|---|---|
| 7 day work-week or year-long operation | 219 |
| 5 day work-week or 250 days worked/year | 320 |

Traffic would increase in the area. Roads and highways that would be impacted and fatality estimates are undeterminable at the present time. Should subsidence occur as a result of longwall mining, the surface of the proposed lease area would be unsuitable for road and current rights-of-way uses.

d. Delay-the-Action Alternative

Should Western be granted the lease after the delay, the impacts would be the same as described for the proposed action, except additional hauling may be required during the delay. If another owner is granted the lease, impacts would be the same as described under the other-owner alternative.

2. Recommended Mitigation

The successful bidder must document to the BLM that all current rights-of-way holders have been notified that underground mining operations may interfere with current rights-of-way uses.

The mining operation must be designed so that current uses of the rights-of-way would not be affected. This would prevent any disruption in the transportation of natural gas and electricity over the proposed lease area.

The successful bidder must document to the BLM that alternative routes for the present rights-of-way have been acquired. The successful bidder must then make these routes available to current rights-of-way holders at rates no greater than the BLM charges or will charge rights-of-way holders to cross the proposed lease area. These alternative routes must be used if the mining operation makes the proposed lease area unsuitable for present rights-of-way uses.

## L. Grazing

### 1. Impacts

#### a. Proposed Action

The following estimated acres and AUMs per allotment would be lost by construction of service roads and ventilation shafts.

| | Steven's Arroyo | | Shumway Arroyo | |
|---|---|---|---|---|
| | Acres | AUMs | Acres | AUMs |
| Service roads (Average 25' width) | 1 | .1 | 6 | .7 |
| Ventilation shafts (200' x 200') | 2 | .2 | 5 | .5 |
| TOTAL | 3 | .3 | 11 | 1.2 |

Additional vegetative and surface damage or destruction would occur on approximately 16 acres during the exploratory drilling phase. The extent of this damage and number of acres involved per allotment is unknown. Some livestock harassment would occur, primarily during construction. Livestock would avoid the area at this time. Additional AUM, range improvement, and livestock damage or destruction could be caused by subsidence.

#### b. Other-Owner Alternative

Additional vegetative and surface damage would occur should new mine facilities be constructed on one of the two allotments within the proposed lease area. The following are estimates of the total acreage and AUM losses should these facilities be developed on the Shumway Arroyo Allotment. Acreage figures for service roads and ventilation shafts are the same as the proposed action.

|  | Acres | AUMs |
|---|---|---|
| Service roads | 6 | .7 |
| Ventilation shafts | 5 | .6 |
| Ancillary facilities | 11 | 1.2 |
| Portal access corridor | 9 | 1.0 |
| TOTAL | 31 | 3.5 |

The following are estimates of acreage and AUM loss should new mine facilities be developed on the Steven's Arroyo Allotment. Acreage for service roads and the ventilation shaft is based on the proposed action. (Acreage of the ventilation shaft and service road on section 36 is excluded.)

|  | Acres | AUMs |
|---|---|---|
| Service roads | 1 | .1 |
| Ventilation shaft | 1 | .1 |
| Ancillary facilities | 11 | 1.1 |
| Portal access corridor | 9 | .9 |
| TOTAL | 22 | 2.2 |

Additional vegetative and surface damage would occur on approximately 16 acres during the exploratory drilling phase. The extent of vegetative damage and number of acres involved per allotment is unknown. Impacts on livestock and range improvements within the lease area would be the same as the proposed action.

### 2. Irreversible and Irretrievable Commitments of Resources

Grazing losses, identified as impacts would be irretrievable from the initial disturbance until mining ceased and reclamation was completed.

## M. Wilderness

No wilderness study areas or inventory units under intensive inventory for wilderness characteristics would be impaired by the proposed action or by any of the other alternatives. The State Director of the BLM published his final decision on the initial inventory recommendations on July 9, 1979.

## N. Land Status

### 1. Impacts

#### a. Proposed Action

The development of a coal mine on the proposed lease area would have administrative impacts on the current land status. The holder of a coal lease has the right to use the public land (Federal surface estate) as necessary and proper for the development of the coal resource. This would limit the types of future surface uses that the BLM could permit. Since a coal lease is issued subject to prior existing rights, the BLM would have to assure that previously granted rights on the proposed lease area would not be infringed by the coal mining operation. No impacts are anticipated on BLM-granted rights-of-way. All parties involved in the six rights-of-way have agreed in writing to coal leasing.

#### b. Other-Owner Alternative

Impacts would be the same as the proposed action.

### 2. Recommended Mitigation

The successful bidder will not be allowed to begin mining operations until documentation is provided to the BLM that all owners of the surface estate have been notified that underground mining operations may affect current land uses of the surface estate. The successful bidder also must document that agreements have been made with owners of the surface estate concerning: current and reasonable foreseeable land uses of the surface estate; current and future values of the surface estate; and a method and rate of reimbursement for any damages to the surface estate that may occur.

## O. Cultural Resources

### 1. Impacts

#### a. Proposed Action

Archeological sites are fragile and occur on or near the land surface. They consequently would be destroyed by the drill holes, any road construction necessary for exploration, and by ventilation shafts built during mining. It appears that Site 3434, a Pueblo II sherd scatter possibly eligible for the National Register, may be destroyed by a ventilation shaft. If pillars were left in place following room-and-pillar mining, surface subsidence and impacts to cultural resources should be negligible. However, if the pillars later were mined, the ensuing 6 to 10 feet of subsidence would cause severe damage and destruction to the 14 known to 69 estimated archeological sites (see Tables II-4 and II-5). Ten of the known sites and an unknown number of estimated sites may be eligible for the National Register. Subsidence and accompanying tension cracks and compression bulges would destroy adobe and masonry walls, break artifacts, and alter site stratigraphy, thereby destroying the natural and cultural context necessary to interpret scientific data. Artifacts must be mapped in situ in three dimensions to yield the best possible information. Alteration of the relationships of those three dimensions severely weakens the critical spatial and temporal control of the archeologist. Any educational/recreation value of sites also would be lessened.

Professional recording, testing, and excavation, if done prior to damage, would provide beneficial scientific information, but the physical loss of the site would preclude future re-examination guided by new questions and procedures.

Unauthorized collection from sites by employees traveling on the proposed lease area may be an indirect impact of the proposed action.

### b. No-Action Alternative

Archeological sites would continue to suffer from natural erosion and unauthorized collection.

### c. Other-Owner Alternative

Sites would be destroyed by drill holes, road construction, ventilation shafts, and subsidence. If the state lease on section 36 was not transferred to another owner and mined, ten fewer archeological sites would be damaged. Construction of a new portal and ancillary facilities could damage one additional site.

## 2. Recommended Mitigation

The BLM cannot request an archeological survey of the proposed lease area before processing a lease application. If a lease was let, an intensive inventory of Federal and private lands, assuming landowners' consent, would be made prior to approval of the mining plan. More precise cultural resource analysis could then be done by the Office of Surface Mining. The mining plan must state that if subsidence occurs the lessee shall mitigate sites eligible for the National Register (36 CFR 60, 36 CFR 800) on Federal lands and on private lands where the surface owner's consent can be obtained. To insure site protection, subsidence must be monitored during and for five years after the life of the deep mine. The BLM must be contacted immediately if subsidence begins.

Mitigation must suit the type and significance of the site, and be approved by the BLM and the State Historic Preservation Officer. Re-examination of site condition and testing for site depth may be necessary to decide which measures should be taken. Site 3434, which appears to be within the large area slated for a ventilator shaft, must be evaluated and mitigated according to 36 CFR 800 if it cannot be avoided by relocation of the shaft. (See Table I-3 for relevant laws and regulations.)

### 3. Unavoidable Adverse Impacts

#### a. Proposed Action

If pillars were left in place following room-and-pillar mining, subsidence and impacts to cultural resources should be negligible. However, all sites within an area of subsidence would be severely damaged or destroyed. Subsidence over the entire proposed lease area would affect from 14 documented to 69 estimated sites, ranging from the Archaic period to Euro-American times (5000 B.C.-recent) and possessing varying degrees of archeological significance. Some of these sites may be eligible for the National Register. If sites were mitigated prior to damage, scientific information would be recorded and interpreted, but the physical sites would be lost.

#### b. No-Action Alternative

Continuation of natural erosion and unauthorized collection of artifacts.

#### c. Other-Owner Alternative

About sixty sites would be affected as in the proposed action.

### 4. Short-Term Use and Long-Term Productivity

Site loss from excavation and subsidence in the proposed action, other-owner, and delayed-action alternatives would destroy long-term productivity of some cultural resources, since research and improved methods could not be implemented. The no-action alternative would not affect sites.

### 5. Irreversible and Irretrievable Commitments of Resources

Wherever subsidence or construction occurred in the proposed action, other-owner, and delayed-action alternatives, sites would be irretrievably lost. Some sites would be partially studied prior to destruction.

## P. Socioeconomic Conditions

### 1. Impacts

#### a. Proposed Action

Mining the proposed lease area would result in the continuation of existing socioeconomic influences over a longer period of time.

##### 1) Demographic Features

Granting of the proposed lease would result in employment of an estimated 392 persons for the mining operation, but this probably would not result in demographic changes to the county. Potential population expansion would be offset if some of the construction workers phased out of present jobs at the San Juan Generating Station were employed in the mining operation. Construction workers leaving the county as current construction projects end might balance the number of outsiders coming in for mining jobs. A significant number of unemployed and underemployed persons within the county also would be available for job placement at the mine.

##### 2) Economic Characteristics

Income patterns within San Juan County should not change noticeably. However, since average wages of employees in the coal mining field are significantly higher than nearly all other local employment categories, the economic situation of individual families could be improved considerably. The higher wages of mine employees could result in some inflationary increases in the local price of goods and services. This impact could affect persons on fixed incomes. Also, there could be a psychological impact in that some persons would feel poorer and, in fact, would be relatively poorer. (See Appendix E for information on comparative wages in northwestern New Mexico.)

Mining on the proposed lease area would probably generate less than six percent of the energy-related employment within the county. Mine jobs would not be expected to result in additional indirect employment opportunities. Fairly recent energy-related and other developments in the area have already led to the expansion of commerce and services. (U.S. Dept. of Interior, Bureau of Reclamation, 1977.) Furthermore, economic impacts of increased mine employment would be offset by expected declines in local construction.

Unemployment in the county might rise slightly for a short period as more persons moved into the area in anticipation of mining jobs than actually found work, and as unemployed family members accompanied successful job seekers into the county.

Mining could result in a positive economic impact to San Juan County. The New Mexico Severance Tax Act provides for a tax of $.38 a ton on steam coal. Under this act, revenues would be paid to the State. Federal law requires that 50 percent of the royalties received for Federal coal be returned to the state where the coal is mined. While it is not required, funds from both these sources could be directed back to San Juan County to help finance needed public projects.

### 3) Social and Cultural Characteristics

Families of construction workers who found mine employment could become more permanently established in the local society. The degree of cultural impacts on individual families would depend on the proportion of individuals from different cultures employed at the mine. Additional, but unquantifiable, strain could be placed on the value systems and traditions of native Indians, Hispanos, and Anglos.

### 4) Community Infrastructure

Costs for public services would not be expected to exceed revenues, since neither population growth nor population concentrations in particular communities would be expected to occur. It is unlikely that any noticeable impact on government and administrative groups would develop, especially since the area has been preparing for and experiencing fairly rapid population expansion during the earlier part of this decade.

No serious additional demands on the housing supply within San Juan County would be anticipated. Based on current housing patterns within the county, approximately 48 percent of the persons employed might be expected to live in Farmington, 42 percent in unincorporated areas, 7 percent in Aztec, and 3 percent in Bloomfield (San Juan County Planning Dept., 1977). Although there is a housing shortage within the county, a current housing report for the area indicates that recent unit construction has been in excess of units needed to meet demand generated by a moderate rate of area development (San Juan County Planning Dept., 1978).

The need for public services including education, health care, police protection, and fire control would change little as a result of mine development, except that demands might be increased in some places due to population shifts.

There would be some impact on the electric, natural gas, and telephone systems serving the area and on the water supply, sewage, and solid waste facilities. The effect on any particular system cannot be forecast accurately without knowledge of what population shifts would take place within the county.

### b. No-Action Alternative

No significant impacts on socioeconomic conditions would result if coal was mined elsewhere in the county at the same rate and by the same number of employees. An unquantifiable loss of workers could result if an equivalent amount of coal was not mined within the county.

The Federal Government would lose potential royalties from unmined Federal coal in the proposed lease area and the State of New Mexico would lose the 50 percent share of these royalties allotted to the state. New Mexico also would lose potential severance tax revenues if coal from another state or Indian coal was substituted for coal from the proposed lease area, as well as potential revenues from the mining of state-owned coal in section 36.

### c. Other-Owner Alternative

Socioeconomic conditions described for the proposed action would be intensified for approximately 14 years if separate underground mines were in operation on Western's existing leases and on the proposed lease area. Based on the current persons per job ratio within the county, the population would be approximately 1,000 persons or 1,650 persons higher than otherwise, depending on whether the company would dispose of the coal locally or truck it to the railroad at Gallup (assuming that 392 persons would be employed for mining and an additional 234 for transporting the coal). To meet standards, these additional populations would require increases of 260 or 425 housing units; 1 dentist, 2 or 3 physicians, 4 or 6 registered nurses, 1 or 2 licensed nurses, 4 or 9 hospital beds; 11 or 19 public school teachers, 5 or 9 school support staff, 11 or 20 school rooms; and 2 or 3 public officers. In addition, electric rates would probably increase if Western was forced to purchase coal for the San Juan Generating Station or mine an equivalent amount elsewhere. Also, the State of New Mexico would not receive the potential revenues from the mining of state-owned coal in section 36.

## 2. Unavoidable Adverse Impacts

### a. Proposed Action

There could be increases in the local price of goods and services. Also, there could be a psychological impact in that some persons would feel poorer and, in fact, would be relatively poorer. Unquantifiable strain could be placed on the value systems and traditions of native Indians, Hispanos and Anglos.

### b. No-Action Alternative

The potential revenues to the Federal Government and the State of New Mexico would be lost.

#### c. Other-Owner Alternative

The unavoidable adverse impacts would be similar to those of the proposed action. Additional adverse impacts would include probable higher costs of electricity produced at the San Juan Generating Station and loss of revenues to the state.

### 3. Short-Term Use and Long-Term Productivity

#### a. Proposed Action

Commerce within the county would be supported by mine employment, and the current expansion and improvement of services and facilities would continue. Additions to community facilities would remain beyond the period of mining activity. Equivalent employment within the area might not be available for those persons losing their jobs at the end of the mining operation.

Social and cultural changes in the lifestyles of the Indian and Hispanic populations would be accelerated to some extent.

#### b. No-Action Alternative

Changes in traditional beliefs, lifestyles, and practices within the area would take place at a slightly slower pace than under the proposed action.

#### c. Other-Owner Alternative

The relationship between short-term and long-term productivity would be basically the same as the proposed action. Socioeconomic effects resulting from mining in the area may be intensified for a relatively short period if Western and a second company both operate underground mines in the area.

#### d. Delay-the-Action Alternative

Socioeconomic effects from mining coal might be slightly more or less intense if the coal was leased after a delay, depending on the state of other energy-related projects within the county.

### 4. Irreversible and Irretrievable Commitments of Resources

#### a. Proposed Action

Throughout the life of the mine there could be an estimated 310 non-fatal mine injuries and 3 fatalities, based on averages of accidents per ton of coal mined (Harbridge House, Inc., 1978).

b. No-Action Alternative

Although socioeconomic resources would be affected, the extent cannot be quantified, but would be of the same type as the proposed action.

c. Other-Owner Alternative

Commitment of socioeconomic resources under this alternative would be the same as the proposed action alternative.

d. Delay-the-Action Alternative

This alternative would be the same as the proposed action, except that the commitment of socioeconomic resources would occur at a later date.

# CHAPTER IV

# CONSULTATION AND COORDINATION

# CHAPTER IV

# CONSULTATION AND COORDINATION

Continuous consultation between BLM and Western was held during the development of this document.

The New Mexico Highway Department was consulted by BLM concerning the traffic fatality rate for San Juan County.

Consultation was made by BLM with Dabney Ford, Cultural Resource Management Program, San Juan Branch, New Mexico State University, concerning types of archeological sites expected to be present on the proposed lease area. Consultation will be held with the State Historic Preservation Officer following an archeological survey of the proposed lease area.

Consultations concerning facilities, planning, land-use regulations, and socioeconomic conditions were held with the following government agencies: City of Farmington, Planning and Public Works Departments; San Juan County Planning Department; San Juan Regional Committee Office; and Four Corners Regional Commission.

Western has consulted with the City of Farmington and Public Service Company of New Mexico and obtained consent to conduct underground coal mining operations beneath existing transmission line rights-of-way on the proposed lease area (Figures IV-1 and IV-2).

Western also has consulted with El Paso Natural Gas Company and is taking steps to obtain consent to mine under existing natural gas pipeline rights-of-way (Figure IV-3). (Locations of transmission line and pipeline rights-of-way in the proposed lease area are shown on Map II-4.)

Western has appointed an agent to consult with owners of surface tracts in the proposed lease area (Figure IV-4). This agent has been engaged to obtain waivers from surface owners for surface damage that may result from underground mining.

TAH COLO.
RIZ. N.M.

CITY OF FARMINGTON, NEW MEXICO
ELECTRIC UTILITY DEPARTMENT
505/ 327-7701

February 16, 1979

Western Coal Co.
P. O. Box 1026
Albuquerque, New Mexico 87103

Attention: George Byers

Gentlemen:

This letter is in response to your visit with me on February 13, 1979 to obtain the consent of the City of Farmington for Western Coal Co. to conduct underground coal mining operations beneath portions of two transmission line rights-of-way held by the City. These rights-of-way (NM 0523181 and NM 24904) cross the southern portion of Sec. 35, T.30N., R.15W, NMPN.

The City of Farmington will be happy to cooperate fully with Western Coal Co. in the needed expansion of its mining operation. On February 13, 1979, Western Coal Co. assured me that, to the extent there will be any threat of interference with the use of these two rights-of-way, Western will take all necessary steps to mitigate any damage or disruption in electrical service as a result of this interference.

In addition to assisting the City in maintaining continuity of service, I understand that Western, when construction commences, will provide the City with a legal instrument to clarify that Western will assume all liability for any disruption of service.

If I may be of any further assistance in this project, please feel free to contact me at any time.

Very truly yours,

FARMINGTON ELECTRIC UTILITY SYSTEM

W C Lewis
W. C. Lewis
Director

WCL:mb

FIGURE IV-1

P.O. BOX 900, 87401

FEB 20 1979

PNM PUBLIC SERVICE COMPANY OF NEW MEXICO
Post Office Box 2267 / Albuquerque, New Mexico 87103

February 20, 1979

Charles E. Hunter
Vice-President
Western Coal Company
Sandia Savings Building
Albuquerque, NM 87103

RE: BLM Lease Application NM28093

Dear Mr. Hunter:

This letter will confirm the Public Service Company of New Mexico (PNM) position as regards to your proposed BLM Lease NM28093.

My understanding is that your Company will develop an underground coal mine under the proposed lease and that the effect on the surface has not been determined at this time.

PNM does have two rights of way that cross through the proposed lease area. One BLM permit, NM20432 is for a 345 kV electrical transmission line crossing Sections 23, 25 and 26, T.30N., R.15W. The other BLM permit, NM0500196 is for a 115 kV electrical transmission line crossing through Sections 26 and 35, T.30N., R.15W.

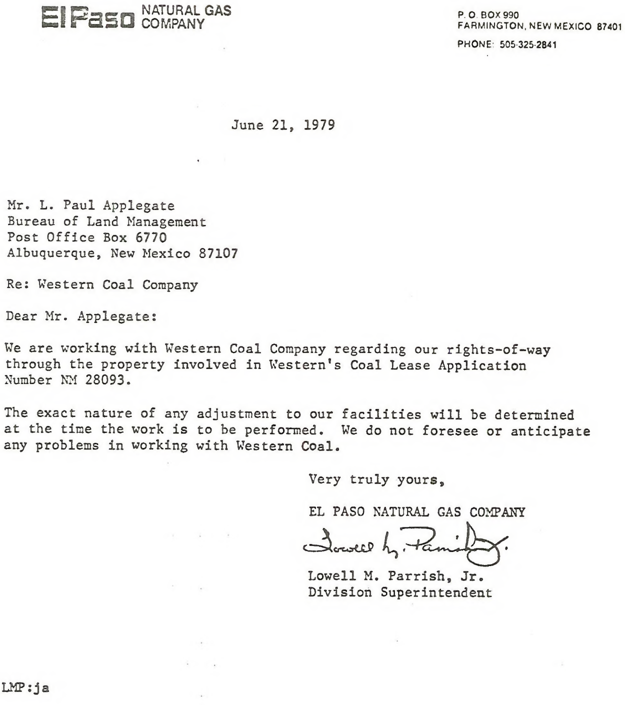
PNM agrees with the proposed mining lease and consents to the issuance to Western Coal Company by the BLM. This consent is based on the understanding that should the development of the underground mine require any adjustments in the existing two electrical transmission lines, Western Coal Company will reimburse PNM for such expenses.

Very Truly Yours,

C D Bedford
C. D. Bedford
Vice-President

CDB/mk

FIGURE IV-2



El Paso NATURAL GAS COMPANY

P. O. BOX 990
FARMINGTON, NEW MEXICO 87401
PHONE: 505-325-2841

June 21, 1979

Mr. L. Paul Applegate
Bureau of Land Management
Post Office Box 6770
Albuquerque, New Mexico 87107

Re: Western Coal Company

Dear Mr. Applegate:

We are working with Western Coal Company regarding our rights-of-way through the property involved in Western's Coal Lease Application Number NM 28093.

The exact nature of any adjustment to our facilities will be determined at the time the work is to be performed. We do not foresee or anticipate any problems in working with Western Coal.

Very truly yours,

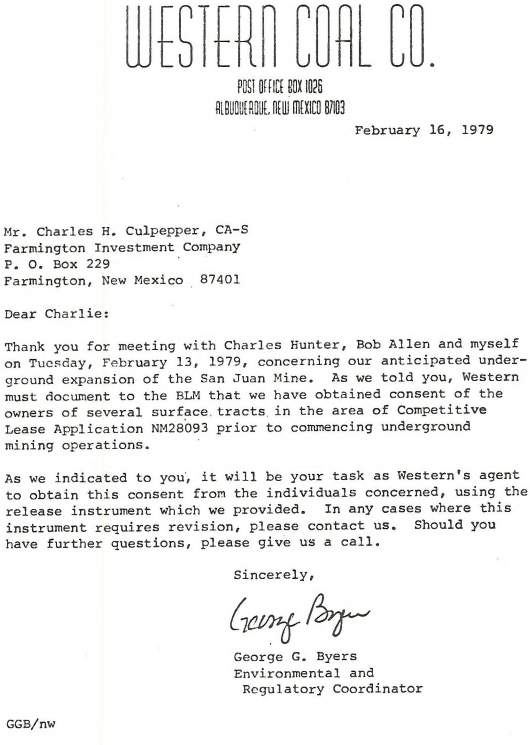
EL PASO NATURAL GAS COMPANY

Lowell M. Parrish

Lowell M. Parrish, Jr.
Division Superintendent

LMP:ja

FIGURE IV-3



WESTERN COAL CO.
POST OFFICE BOX 1026
ALBUQUERQUE, NEW MEXICO 87103

February 16, 1979

Mr. Charles H. Culpepper, CA-S
Farmington Investment Company
P. O. Box 229
Farmington, New Mexico 87401

Dear Charlie:

Thank you for meeting with Charles Hunter, Bob Allen and myself on Tuesday, February 13, 1979, concerning our anticipated underground expansion of the San Juan Mine. As we told you, Western must document to the BLM that we have obtained consent of the owners of several surface tracts in the area of Competitive Lease Application NM28093 prior to commencing underground mining operations.

As we indicated to you, it will be your task as Western's agent to obtain this consent from the individuals concerned, using the release instrument which we provided. In any cases where this instrument requires revision, please contact us. Should you have further questions, please give us a call.

Sincerely,

George Byers

George G. Byers
Environmental and
Regulatory Coordinator

GGB/nw

FIGURE IV-4

# CHAPTER V

# SUPPORTING MATERIALS

# LIST OF PREPARERS

| Name | Title | Area of Responsibility |
|---|---|---|
| Bill Sharp | Supervisory Environmental Program Specialist | Team Leader |
| Robert Archuleta | Natural Resource Specialist | Technical Coordinator |
| Carol M. Thompson | Writer/Editor | Editor |
| John E. Bristol | Landscape Architect | Graphics Coordinator |
| Jeffery S. Nighbert | Cartographic Technician | Graphic Artist |
| John C. Arwood | Range Conservationist | Resource Writer (Grazing) |
| Richard Bird | Soil Scientist | Resource Writer (Soils) |
| John E. Bristol | Landscape Architect | Resource Writer (Noise, Visual Resources, Recreation, Wilderness) |
| R. A. Diener | Wildlife Biologist | Resource Writer (Wildlife) |
| Cheryl Ferguson | Archeologist | Resource Writer (Cultural Resources) |
| Donald R. Floding | Community Planner | Resource Writer (Socioeconomic Conditions) |
| Jim Fogg | Hydrologist | Resource Writer (Water Resources) |
| S. A. Lowance | Conservation Agronomist | Resource Writer (Climate, Air Quality, Vegetation) |
| Steve R. Marcus | Geologist | Resource Writer (Geologic Setting) |
| Ronald A. Montagna | Realty Specialist | Resource Writer (Land Status, Transportation) |
| Coleman R. Robison | Geologist (Paleobotany) | Resource Writer (Paleontology) |
| Eleanor Pfeifer | Clerk-Typist | Office Service Manager |
| Stephanie Rowe | Clerk-Typist | Word Processor |

# DOCUMENT RECIPIENTS

## FEDERAL GOVERNMENT

### Agencies

- Department of Agriculture
  - Agriculture Stabilization & Conservation Service
  - Farmers Home Administration
  - Soil Conservation Service
- Department of Commerce
  - Economic Development Administration
- Department of Energy
- Department of Housing & Urban Development
- Department of the Interior
  - Bureau of Indian Affairs
    - Albuquerque Area
    - Navajo Area
  - Bureau of Land Management
  - Bureau of Mines
  - Bureau of Reclamation
  - Heritage Conservation & Recreation Service
  - National Park Service
  - Office of Surface Mining Reclamation & Enforcement
  - U.S. Fish & Wildlife Service
  - U.S. Geological Survey
- Department of Transportation
  - Federal Highway Administration
- Environmental Protection Agency

### Officials

Senator Pete V. Domenici

Senator Harrison Schmitt

Representative Manual Lujan, Jr.

Representative Harold Runnels

## TRIBAL GOVERNMENT

- Navajo Nation
  - Chairman Peter McDonald
  - Chapters
    - Fruitland
    - Shiprock
    - Waterflow
- Southern Ute Tribe
  - Chairman Leonard C. Burch
- Ute Mountain Ute Tribe
  - Chairman Scott Jacket

## STATE GOVERNMENT

### State of New Mexico Agencies

- Commerce & Industry Department
  - Economic Development Division
- Department of Finance & Administration
  - Council of Governments
- Educational Finance & Cultural Affairs Department
  - Historic Preservation Bureau
- Energy & Minerals Department
  - Energy Conservation & Management Division
  - Mining & Minerals Division
  - Oil Conservation Division
- Health & Environment Department
  - Environmental Improvement Division
- Highway Department
- Natural Resources Department
  - Game & Fish Department
  - Soil & Water Conservation Divison
  - Water Resources Division
- State Land Office

### Officials

Governor Bruce King

Senator Jack Morgan

Senator John Pinto

Senator Raymond Sitta

Representative Reginald Begaye

Representative D. Polk Brown

Representative Jerry Sandel

Representative Boyd Scott

## LOCAL GOVERNMENT

Four Corners Regional Commission

McKinley Area Council of Governments

San Juan Regional Committee

San Juan County Extension Agent

San Juan County Planning Department

City of Aztec

City of Bloomfield

- City of Farmington
  - Electric Utility Department
  - Planning Department
  - Public Works Department

## PRIVATE GROUPS AND INDIVIDUALS

### Companies

El Paso Natural Gas

Fruitland Land and Cattle

Kelly Family Land

Public Service Company of New Mexico

Wagon Rod Ranch, Inc.

Western Coal

### Societies

New Mexico Archeological Society

San Juan County Museum Association

Sierra Club

### Universities

- Eastern New Mexico
  - Agency for Conservation Archeology
- New Mexico State (San Juan Campus)
  - Cultural Resource Management Program

### Private Citizens

Karl E. Bond

Morgan Bond

Bonnie Kennedy Crook

Bertha Doolittle

Mary Fitzgerald

Phil Foutz

Charles S. Gardner

John Gardner

Margaret Ann Gyure

C. R. Hancock

Craig M. Horn

Michael L. Keleher

Clement Koogler

Mabel W. Lester

Stanley McCabe

David Miller

Ronald Miller

Winifred B. Sill

Mary Snouse

Mary Wallace

Carwin L. Watts

Joseph Laverne Watts

Shirley Whipple

Robert C. Witten (Trustee)

## APPENDIX A

## ROLES OF KEY FEDERAL, STATE, AND COUNTY AGENCIES IN COAL DEVELOPMENT

| Agency | Role |
|---|---|
| Federal | |
| Department of Agriculture<br>Soil Conservation Service | - Provides expertise for analysis and regulation of coal development effects on prime farmland |
| Department of Energy | - Establishes energy production, use, and conservation goals<br>- Fosters competition for Federal leases<br>- Implements alternative bidding systems<br>- Establishes diligence requirements<br>- Sets production rates<br>- Specifies terms for royalty interests taken in kind |
| Department of Interior<br>Bureau of Land Management | - Leases Federal minerals<br>- Prepares lease terms<br>- Adjudicates qualifications of potential lessees<br>- Conducts lands-use planning<br>- Analyzes impacts of leasing actions on the environment<br>- Assures protection of other resources |
| Bureau of Mines | - Conducts research on varied aspects of coal development |
| Bureau of Reclamation | - Provides expertise for analysis and regulation of coal development effects on water resources |
| Office of Surface Mining | - Approves or disapproves mining and reclamation plans<br>- Regulates surface mining<br>- Regulates surface effects of underground mining<br>- Pursuant to section 522(c) of the Surface Mining Control and Reclamation Act of 1977, officially designates lands unsuitable for leasing in response to petitions |
| U.S. Fish and Wildlife Service | - Provides expertise for analysis and regulation of coal development effects on wildlife, including threatened and endangered species |
| U.S. Geological Survey | - Provides technical expertise concerning coal occurrence and market value<br>- Evaluates maximum coal recovery<br>- Evaluates mining techniques<br>- Recommends bond, royalty and rent amount<br>- Conducts environmental studies on leased coal lands<br>- Regulates operations on leased coal lands |
| Department of Justice | - Antitrust Division adjudicates conflicts of interest and antitrust cases between time of lease sale and lease issuance. |
| Department of Labor<br>Mine Safety and Health Administration | - Enforces regulations protecting the health and safety of miners |
| Environmental Protection Agency | - Regulates the environmental effects of mining |
| State | |
| Energy and Minerals Department<br>Mining and Minerals Division | - Conducts environmental hearings<br>- Approves or disapproves mining and reclamation plans<br>- Grants permits<br>- Inspects mines for adherence to environmental protection regulations |
| Health and Environment Department<br>Environmental Improvement Division | - Regulates sanitation |
| Natural Resources Department<br>Water Resources Division | - Has jurisdiction over water resources |
| County | |
| San Juan County<br>Building Inspector | - Issues building permits<br>- Enforces county building regulations |

Source: After U.S. Dept. of Interior, Bureau of Land Management, 1979a.

# APPENDIX B

## SOIL MAPPING UNIT DESCRIPTIONS

### Soil Mapping Unit Av

The Avalon soils in this mapping unit are 5 feet or more thick. They formed in mixed alluvium from sedimentary rock and wind blown material on mesas and plateaus. These soils are on broad rolling terraces and old outwash plains with slopes of 2 to 5 percent. The scientific name for these soils is fine-loamy, mixed, mesic, Typic Calciorthids.

Typically these soils have a sandy loam surface layer about 4 inches thick, a sandy loam subsoil about 10 inches thick, and a sandy clay loam substratum to about 53 inches.

Permeability is moderately rapid to about 14 inches, moderately slow to about 53 inches, and moderately rapid below. The available water capacity is high. The effective rooting depth is about 60 inches for short growing plants. Surface runoff is slow to medium, and erosion hazard is slight to moderate. The soil blowing hazard is high. Excess lime may cause chlorosis in some plants, primarily trees.

### Soil Mapping Unit BA

The Badland soils in this mapping unit consist of rolling to very steep, barren shale on hills, breaks, upland canyons, and valleys. The mapping unit is dissected by many intermittent channels with sparse vegetation.

### Soil Mapping Unit BB

The Badlands-Monierco-Rock outcrop complex of soils in this mapping unit consists of nearly level to moderately steep areas on knolls, ridges, plains, hills, and breaks. The Badlands make up about 40 percent of the mapping unit, the Monierco soil 30 percent, and Rock outcrop about 20 percent. The remaining 10 percent are inclusions of other soils. The Monierco soil ranges in slope from 0 to 8 percent. The Badlands and Rock outcrop range up to 15 percent slope. The Badlands is an area of barren shale dissected by many intermittent drainage channels. The Monierco soil is a shallow, well drained soil. It formed in wind blown material, water deposited sediments, and soil formed in place from weathering of sedimentary rock on knolls, plains, and ridges. The Rock outcrop is barren sandstone. The scientific name for Monierco is loamy, mixed, mesic, shallow Typic Haplargids.

Typically the Monierco soils have a fine sandy loam surface about 2 inches thick and a clay loam or sandy loam subsoil about 12 inches thick. This is underlaid by shale. Permeability is moderately slow. The available water capacity is very low. The effective rooting depth is about 14 inches.

Surface runoff is medium and erosion hazard is moderate. The soil blowing hazard is high.

## Soil Mapping Unit BC

The Badlands-Rock outcrop-Persayo complex of soils in this mapping unit consists of very steep to extremely steep areas on breaks, hills, ridges, and cliffs. The Badlands make up about 35 percent of the mapping unit, Rock outcrop about 30 percent, and the Persayo soil about 20 percent. The remaining 15 percent are inclusions of other soils. The Persayo soil ranges from 30 to 40 percent slopes. The Badlands and Rock outcrop areas range 30 to more than 50 percent slopes. The Badlands is an area of barren shale. The Rock outcrop is an area of barren sandstone. The Persayo soil is a shallow, well drained soil. It formed in place from weathering of sedimentary rock. The scientific name for Persayo is loamy, mixed, (calcareous), mesic, shallow Typic Torriorthents.

Typically the Persayo soils have a clay loam surface about 2 inches thick and a silty clay loam subsoil to a depth of about 12 inches. This is underlaid by shale. Permeability is moderately slow. The available water capacity is very low. The effective rooting depth is about 14 inches. Surface runoff is rapid and the erosion hazard is high. The soil blowing hazard is moderate.

## Soil Mapping Unit BT

The Blancot-Notal association of soils in this mapping unit consists of nearly level to gently sloping areas on alluvial fans and valley bottoms. The Blancot soil makes up about 55 percent of the mapping unit and slopes range from 0 to 5 percent. The Notal soil makes up about 25 percent of the mapping unit and slopes range from 0 to 2 percent. The remaining 20 percent are inclusions of other soils.

The Blancot soil is a deep, well drained soil. It formed in water deposited sediments on alluvial fans. The scientific name is fine-loamy, mixed, mesic, Typic Haplargids. The Notal soil is a deep, well drained soil. It formed in water deposited sediments from sedimentary rock on valley bottoms. The scientific name is fine, mixed, mesic, Typic Camborthids.

Typically the Blancot soils have a loam surface about 2 inches thick, a clay loam subsoil about 13 inches thick, and a sandy clay loam or clay loam substratum to a depth of about 60 inches. Permeability is moderately slow. The available water capacity is high. The effective rooting depth is about 60 inches for short growing plants. Surface runoff is medium and erosion hazard is high. The soil blowing hazard is moderate.

Typically the Notal soils have a silty clay loam surface about 3 inches thick, a clay subsoil about 20 inches thick, and a clay substratum to a depth of about 60 inches.

Permeability is very slow. The available water capacity is moderate. The effective rooting depth is about 60 inches for short growing plants. Surface runoff is medium and the erosion hazard is moderate. The soil blowing hazard is high. Exchangeable sodium ranges from 15 to 40 percent.

## Soil Mapping Unit FA

The Farb-Persayo-Rock outcrop complex of soils in this mapping unit consists of gently sloping to moderately steep areas on upland hills and breaks. The Farb soil makes up about 40 percent of the mapping unit and slopes range from 3 to 30 percent. The Persayo soil makes up about 30 percent and slopes range from 3 to 30 percent. The Rock outcrop makes up about 20 percent. The remaining 10 percent are inclusions of other soils.

The Farb soil is a shallow, excessively drained soil. It formed in place from weathered sedimentary rock. The scientific name is loamy, mixed, (calcareous), mesic, Lithic Torriorthents. The Persayo soil is a shallow, well drained soil. It formed in place from weathered sedimentary rock. The scientific name is loamy, mixed, (calcareous), mesic, Lithic Torriorthents. Rock outcrop is barren, exposed sandstone.

Typically the Farb soils have a fine sandy loam surface about 7 inches thick and a sandy loam substratum about 3 inches thick. Sandstone is at about 10 inches. Permeability is moderately rapid. The available water capacity is very low. The effective rooting depth is about 10 inches. Surface runoff is medium to rapid and the erosion hazard is moderate to high. The soil blowing hazard is high.

Typically the Persayo soils have a clay loam surface about 2 inches thick and a silty clay loam subsoil about 13 inches thick. Shale is at about 15 inches. Permeability is moderately slow. The available water capacity is very low. The effective rooting depth is about 15 inches. Surface runoff is medium to rapid; erosion hazard is moderate to high. The soil blowing hazard is moderate.

## Soil Mapping Unit HA

The Haplargids-Blackston-Torriorthents complex of soils in this mapping unit consists of moderately sloping to very steep areas. The Haplargids soil makes up about 45 percent of the mapping unit and slopes range from 8 to 50 percent. The Blackston soil makes up about 30 percent of the mapping unit and slopes range from 8 to 40 percent. The Torriorthent soil makes up about 23 percent and slopes range from 8 to 50 percent. The remaining 2 percent are inclusions of other soils. Included in about 15 percent of this mapping unit are slopes greater than 50 percent.

The Haplargid soil is a group of related soils. Gravel and cobble cover the surface area but range from 0 to 95 percent in the subsoil and substratum. These soils are shallow to deep and well to excessively drained. They formed in mixed, water deposited gravelly sediments. The Blackston is a deep, well drained soil. It formed in mixed, water deposited gravelly sediments. The scientific name is loamy-skeletal, mixed, mesic, Typic Calciorthids. The Torriorthent soil is a group of related soils. Gravel and cobble cover the surface area but range from 0 to 95 percent in the underlying layers. They are shallow to deep, and well drained to excessively drained. They formed in mixed, water deposited sediments.

Typically the Haplargids have a cobbly sandy clay loam or cobbly loam surface 1 to 8 inches thick. Gravelly textures are sometimes present. The subsoil is a sandy clay loam, loam, clay loam, cobbly sandy clay loam, cobbly loam, or cobbly clay loam 14 to 32 inches thick. Gravelly textures are sometimes present. The substratum is sand clay loam, loam, clay loam, cobbly sandy clay loam, cobbly loam, or cobbly clay loam 0 to 28 inches thick. Gravelly textures are sometimes present. Permeability is moderate to moderately slow. Available water capacity is low to high. Effective rooting depth is 14 to 60 inches. Surface runoff is slow and water erosion and soil blowing hazard is slight.

Typically the Blackston soils have a gravelly loam surface about 2 inches thick, a gravelly loam subsoil about 9 inches thick, and a very gravelly clay loam substratum to about 26 inches. Permeability is moderate to about 11 inches, and moderately slow to about 26 inches. The available water capacity is low to moderate. The effective rooting depth is about 60 inches. Surface runoff is slow and erosion hazard is slight. The soil blowing hazard is slight.

Typically the Torriorthents have a cobbly sandy loam, cobbly sandy clay loam, or a cobbly loam surface 1 to 5 inches thick. Gravelly textures are sometimes present. The substratum is a loam, clay loam, sandy clay loam, sandy loam, cobbly clay loam, cobbly loam, cobbly sandy clay loam, or cobbly sandy loam 10 to 59 inches thick. Gravelly textures are sometimes present. Permeability is moderately rapid to moderately slow. The available water capacity is very low to high. The effective rooting depth ranges from 10 to 60 inches for short growing plants. Surface runoff is slow and the erosion hazard is slight. The soil blowing hazard is slight.

## APPENDIX C

## THREATENED AND ENDANGERED SPECIES OF FISH AND WILDLIFE THAT MAY BE EXPECTED TO OCCUR IN SAN JUAN COUNTY, NEW MEXICO

| Class; species | Listing 1/ | Season of Use | Status | Sightings 2/ |
|---|---|---|---|---|
| Mammals | | | | |
| Black-footed ferret (*mustela nigripes*) | F,S-I | Year-long | E | 1R? 3/ |
| Mink (*Mustela vision energumenos*) | S-II | Year-long | T | 2H' |
| Birds | | | | |
| Mississippi kite (*Ictinia mississippiensis*) | S-II | Occasional | T | 1R, 1R? |
| Bald eagle (*Haliaeetus leucocephalus*) | F,S-I | Winter and migration, 1 nest seen | E | 6R |
| Osprey (*Pandion haliaetus carolinensis*) | S-II | Migration | T | 3R |
| Peregrine falcon (*Falco peregrinus anatom*) | F,S-I | Winter and migration | E | 4R, 1R' |
| Red-headed woodpecker (*Melanerpes erythrocephalus caurinus*) | S-II | Occasional | T | 1R, 1R' |
| Baird's sparrow (*Ammodramus bairdii*) | S-II | Migration | T | 1R |
| Fish | | | | |
| Roundtail chubs (*Gila robusta robusta*) | S-II | Year-long | T | 1R, 2R' |
| Colorado River squawfish (*Ptychocheilus lucius*) | S-I | Year-long | T | 1R |

Source: After Hubbard, et al., 1978.

1/ F - Federal; S-I - species whose prospects of survival or recruitment in the state are in jeopardy; S-II - species whose prospects of survival or recruitment in the state are in jeopardy in the foreseeable future.

2/ H' - verified record, pre-1960; H - unverified record, pre-1960; R' - verified record, 1960 or later; R - unverified record, 1960 or later.

3/ Sighting recorded near San Juan McKinley County Line and included in San Juan data.

# APPENDIX D

## SIX-POINT SCALE FOR DETERMINING SIGNIFICANCE ESTIMATES OF CULTURAL RESOURCES

Estimates of cultural resource significance in this document are based on a 6-point scale intended to provide a means for initial discrimination when site records are the only data available. Three factors have been used to determine site significance: a) uniqueness within a limited area or cultural/temporal framework, b) relative absence of site erosion, and c) relative degree of research or heritage value. It can be argued effectively that all sites are important to anthropological and archaeological research. However, if forced to discriminate between sites, focusing on those with the highest rating would provide a sample of the most intact of known sites. It is felt that such an approach preserves data useful for a broad range of research interests.

Following are the criteria for the 6-point scale used in determining significance estimates:

One Point - A rating given any site for which little or no additional data can be generated once original survey data are recorded. Examples include past site localities that have been completely lost, arroyo dams, and isolated boundary markers.

Two Points - This rating refers to heavily vandalized, eroded, or highly abundant sites for which little new data can be generated by further investigation. Examples include sites largely destroyed by arroyo cutting, isolated Navajo ovens or corrals, and isolated trash scatter.

Three Points - This rating includes sites with moderate erosion or sites that are relatively abundant in the region. For such sites, the probability of additional data is low due to site erosion or to redundant information. Sites with this rating warrant re-examination for final evaluation. Examples include recent Navajo hogans (when abundant) and some lithic scatters in blowouts.

Four Points - This rating includes sites that are relatively intact and present possibilities for data acquisition warranting re-examination and archaeological testing. The category includes eroded sites that are relatively unique cultural manifestations for a given area. Examples include high density lithic scatters without diagnostic artifacts or such datable features as hearths.

Five Points - This rating distinguishes sites that appear to: a) provide a high probability for data acquisition pertinent to cultural/temporal distinctions, resource utilization, and environmental characteristics, or b) are examples of a limited number of cultural manifestations of their type, or c) contain other indicators of particularly high research value. Such sites warrant high priorities for preservation or research. Examples include Archaic sites containing both diagnostic artifacts and datable features, pithouses, small pueblo structures, clustered Navajo habitations, and Paleo-Indian sites. Such sites should be nominated to the National Register of Historic Places.

Six Points - This category is reserved for sites of outstanding research value that display additional historical or heritage significance. Examples include larger pueblos and pithouse villages.

It must be recognized that ranking systems, such as this, are highly subjective and rely on data of varying quality. In addition, varying research interests may lead to quite different classifications. Disagreements with the estimates are to be expected. To minimize unwarranted destruction of cultural resources, it is suggested that all sites be re-examined wherever possible. Minimally, those sites with a significance estimate of three or higher should be re-examined and mitigation measures established before terrain-disturbing activities are permitted. At present, all sites with an estimate of four or greater should be considered eligible for nomination to the National Register. The Advisory Council, through the New Mexico State Historic Preservation Officer, must be consulted prior to excavation or disturbance.

# APPENDIX E

## ESTIMATED ANNUAL WAGES AND LABOR COSTS PER EMPLOYEE
(Northwestern New Mexico)

|  | Employment Field | 1977 Average Wage[1] | Fringe Benefits (percent) | Annual Costs/ Employee |
|---|---|---|---|---|
| 1. | Livestock & Livestock Products | $ 8,171 | 10 | $ 8,988 |
| 2. | Grains & Seed Crops | 5,821 | 10 | 6,403 |
| 3. | Fruits & Nut Trees | 5,821 | 10 | 6,403 |
| 4. | Vegetables | 5,821 | 10 | 6,403 |
| 5. | Agriculture, Forestry & Fish Service | 5,531 | 17 | 6,471 |
| 6. | Other Agricultural Products | 4,450 | 17 | 5,206 |
| 7. | Uranium Mining | 15,630 | 28 | 20,006 |
| 8. | Coal, Bituminous | 18,858 | 28 | 24,138 |
| 9. | Crude, Petroleum | 14,219 | 28 | 18,200 |
| 10. | Natural Gas & Natural Gas Liquids | 14,219 | 28 | 18,200 |
| 11. | Construction Sand & Gravel | 15,667 | 20 | 18,800 |
| 12. | Other Mining | 15,667 | 28 | 20,054 |
| 13. | Residential Construction | 11,498 | 20 | 13,798 |
| 14. | Nonresidential Construction | 14,535 | 25 | 18,169 |
| 15. | Public Utilities Construction | 10,572 | 25 | 13,215 |
| 16. | Highway Construction | 16,238 | 25 | 20,297 |
| 17. | Other Construction (New) | 12,731 | 25 | 15,914 |
| 18. | Maintenance & Repair Construction | 10,571 | 15 | 12,157 |
| 19. | Food & Kindred Products | 18,814 | 16 | 10,224 |
| 20. | Paper & Wood Products | 8,244 | 16 | 9,563 |
| 21. | Printing | 7,322 | 16 | 8,494 |
| 22. | Petroleum Products | 11,634 | 16 | 13,495 |
| 23. | Concrete, Glass & Stone | 9,392 | 16 | 10,895 |
| 24. | Fabricated Metal Products | 11,509 | 16 | 13,351 |
| 25. | Machinery Products | 11,934 | 16 | 13,843 |
| 26. | Electrical Products | 8,225 | 16 | 9,541 |
| 27. | Miscellaneous Manufacturing | 6,755 | 16 | 7,836 |
| 28. | Railroad Transportation | 18,297 | 25 | 22,871 |
| 29. | Local Ground Transportation | 5,447 | 17 | 6,373 |
| 30. | Other Transportation | 12,246 | 16 | 14,205 |
| 31. | Communications | 12,153 | 16 | 14,098 |
| 32. | Electrical Utilities | 17,667 | 28 | 22,614 |
| 33. | Gas Utilities | 14,950 | 28 | 19,136 |
| 34. | Water & Sewer Utilities | 12,876 | 16 | 14,936 |
| 35. | Wholesale Trade | 11,300 | 16 | 13,108 |
| 36. | Retail Trade | 6,300 | 17 | 7,371 |
| 37. | Finance & Insurance | 8,816 | 16 | 10,227 |
| 38. | Real Estate & Homes | 7,345 | 16 | 8,520 |
| 39. | Lodging & Personal & Business Services | 5,605 | 17 | 6,558 |
| 40. | Miscellaneous & Repair Services | 8,572 | 16 | 9,944 |
| 41. | Medical Services | 11,119 | 14 | 12,683 |
| 42. | Entertainment, Education & Nonprofit | 6,797 | 16 | 7,885 |
| 43. | Pipeline Transportation | 17,424 | 23 | 21,416 |
| 44. | Motor Freight Transportation | 13,603 | 20 | 16,324 |

Source: Harbridge House, Inc., 1978.

[1] Per employee costs representative of annual wage, not necessarily a 40-hour work week.

# GLOSSARY

Ac/AUM (Acres/Animal-Unit Month). The number of acres needed to produce the forage required by an animal-unit for one month. An animal unit is considered to be one mature cow and calf, one horse, or five sheep or goats.

AMP (Allotment Management Plan). A program of livestock grazing mangement. An AMP may include range improvements, if required to attain a given set of objectives for a particular grazing allotment.

ARCHAIC. Cultural stage (5000-1000 B.C.) of mobile small-game hunters and gatherers. Sites are usually stone concentrations and hearth areas. They are often in dunes and difficult to locate.

BASKET MAKER. Cultural stage during which sedentary life developed. Sites are usually subterranean pithouse communities or burial caves. The period is noted for beautiful baskets and the development of pottery.

Btu (British thermal unit). The heat needed to raise 1 pound of water 1°F. A Btu is equal to 252 calories.

CHACOAN COMPLEX. Sites within Chaco Canyon National Monument, and sites dispersed throughout the San Juan Basin that may have interacted with those in the canyon to form a sophisticated socioeconomic network of trade and planned redistribution of goods. Outlying sites are often tied to the canyon by a network of roads and visual communication.

GEOPHYSICAL LOG. A record obtained by lowering instruments into boreholes or wells. Meters at the surface make continuous recordings of the physical property being tested.

HYDRAULIC CHARACTERISTICS. The characteristics of a geologic formation that determine its ability to store and transmit water.

KGS (Known Geologic Structure). A subsurface geologic structure that has been identified by the U.S. Geological Survey as having a significant potential for oil and gas production.

KRCRA (Known Recoverable Coal Resource Area). An area designated by the U.S. Geological Survey as containing economic recoverable coal reserves.

LONGWALL MINING. A method of coal mining in which the coal is mined in a single, continuous operation. The emptied space is either filled in or allowed to collapse.

MIXING HEIGHT. The height to which air near the earth's surface is mixed with the air above it.

PALEO-INDIAN. Cultural stage (8000-5000 B.C.) of mobile hunters of big game. Sites are usually small scatters of stone tools and debris, and are difficult to locate.

PAN EVAPORATION. The amount of water that evaporates from a pan 4 feet in diameter, 10 inches deep, and raised 6 inches above the ground when the water level in the pan is maintained within 2 to 3 inches of the top of the pan.

PUEBLO. Cultural stage (700-1500 A.D.) during which domesticates became very important and villages were permanent. Divisions, consisting of Pueblo I-IV, are based on changes in architecture and ceramics. Sites are relatively easy to recognize from surface remains. Pueblo II and III periods (900-1300 A.D) are the best represented on the proposed lease area, probably as a result of increased moisture that is postulated to have occurred during those times. The San Juan area was generally abandoned from 1300 until the Navajo moved in about 1500 A.D.

RANK. A coal classification based on degree of metamorphism of the coal. The lowest rank, lignite, is the least metamorphosed; while the highest rank, anthracyte, is the most highly metamorphosed. Ranking is determined by the number of Btu's in one pound of the coal being classified.

ROCK DUSTING. The process by which dust-size particles of rock are injected into an underground coal mine to mix with coal dust. This lowers the percentage of coal in the dust and, therefore, lowers the likelihood of an explosion in the mine.

ROOM-AND-PILLAR CONFIGURATION. A method of underground coal mining in which the coal is removed from blocks, known as rooms. The rooms are separated by supporting pillars of unmined coal.

STEAMCOAL. A rank intermediate between bituminous and anthracite coals. Some steam coals are especially suitable for steam generation, while others are used for smelting and coke making.

TRANSMISSIVITY. The rate at which water flows through an aquifer. Transmissivity is an indication of the ability of an aquifer to supply water to a well penetrating that aquifer.

TRANSPORT WINDS. Winds which result in the movement of air masses from one geographic region to another.

USLE (Universal Soil Loss Equation). A method of predicting soil loss from areas affected by various land uses. The USLE considers climate, soil, topography, and management factors in estimating future soil losses; however, it does not consider sediment produced from channel erosion processes.

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